ALBERTSON

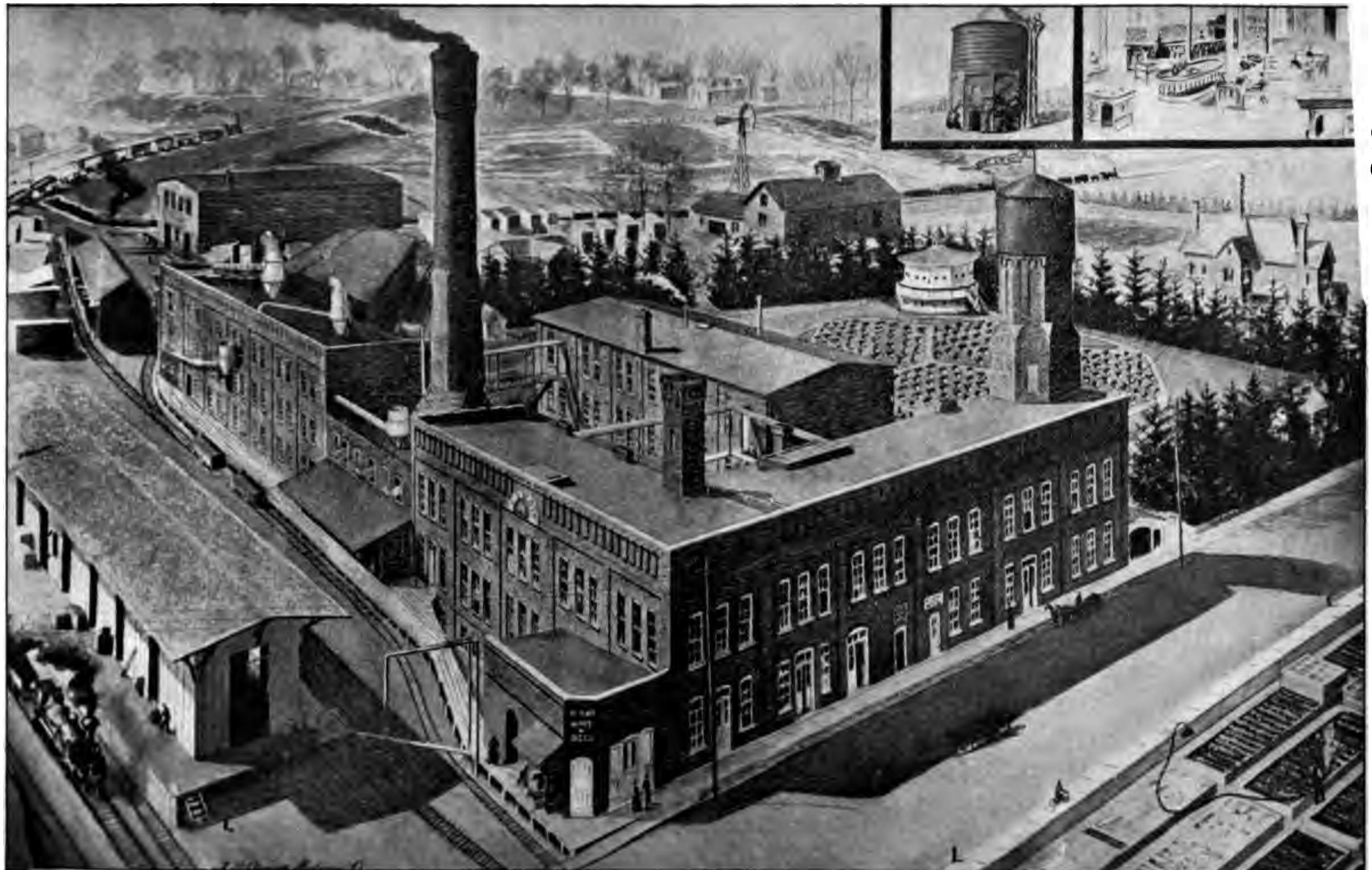


FIG. 1.—THE HOME OF THE HONEY-BEES IN 1901.

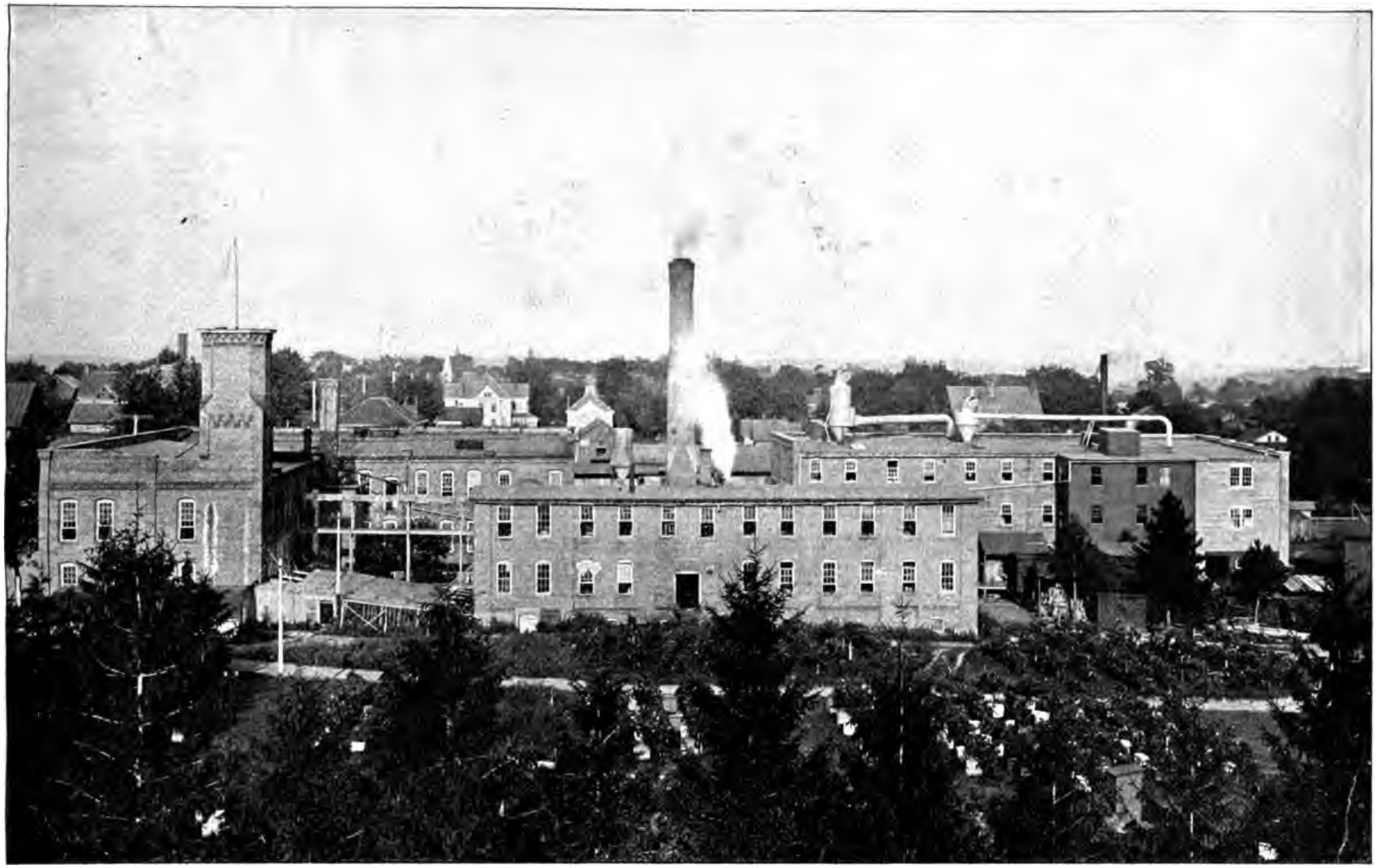


FIG. 2.—GENERAL VIEW OF THE HOME OF THE HONEY-BEES, 1889, LOOKING FROM THE WEST, AND OVERLOOKING THE APIARY.

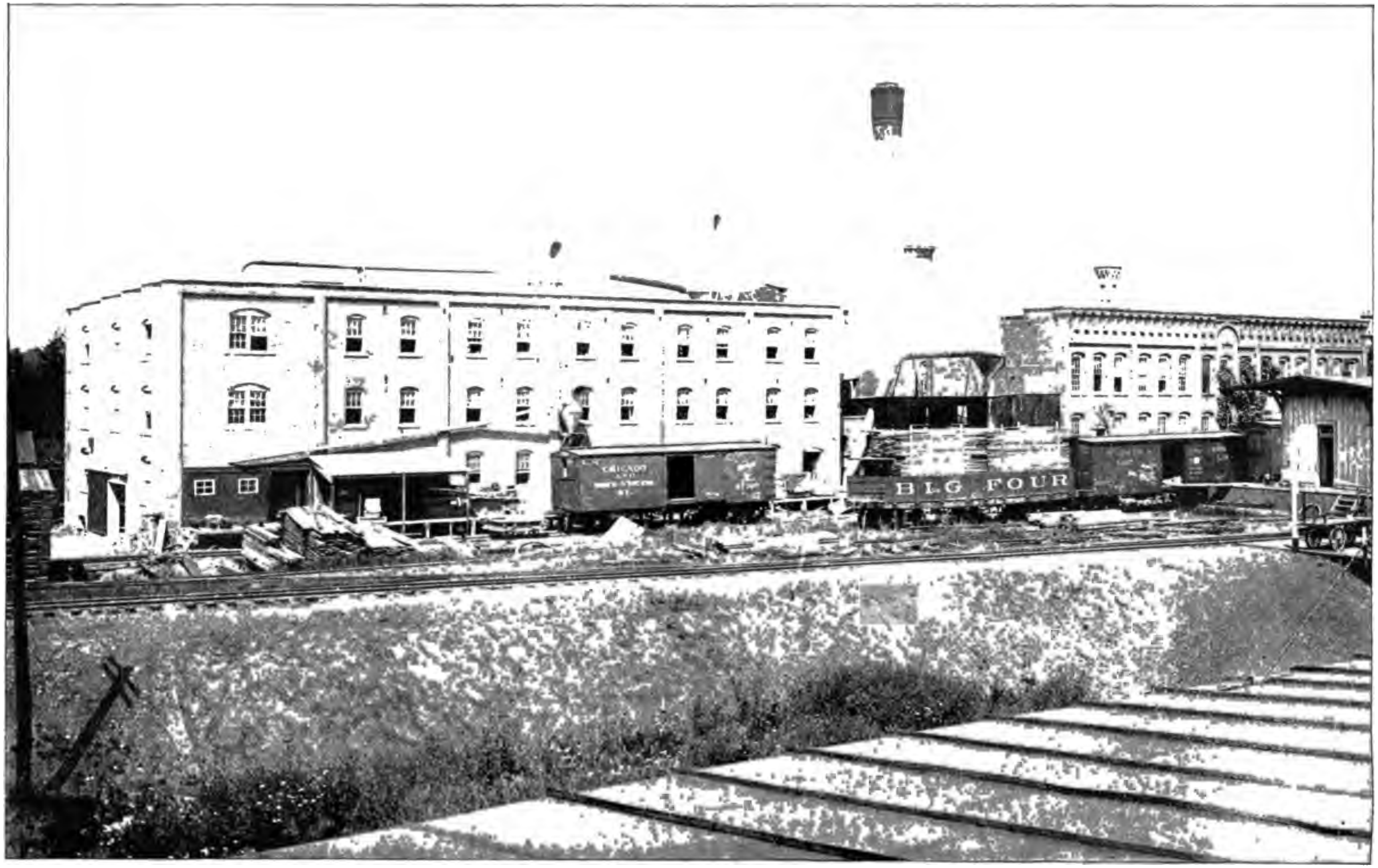


FIG. 3. HOME OF THE HONEY-BEES IN 1899—VIEW FROM SOUTHEAST, SHOWING WOOD-WORKING SHOP IN LEFT FOREGROUND.

FIG. 4.—PART OF THE HOME OF THE HONEY-BEES IN 1899, LOOKING FROM THE SOUTH.

FIG. 5.—PART OF LUMBER-YARDS OF THE HOME OF THE HONEY-BEES, 1889, LOOKING FROM THE TOP OF THE LUMBER-SHED.

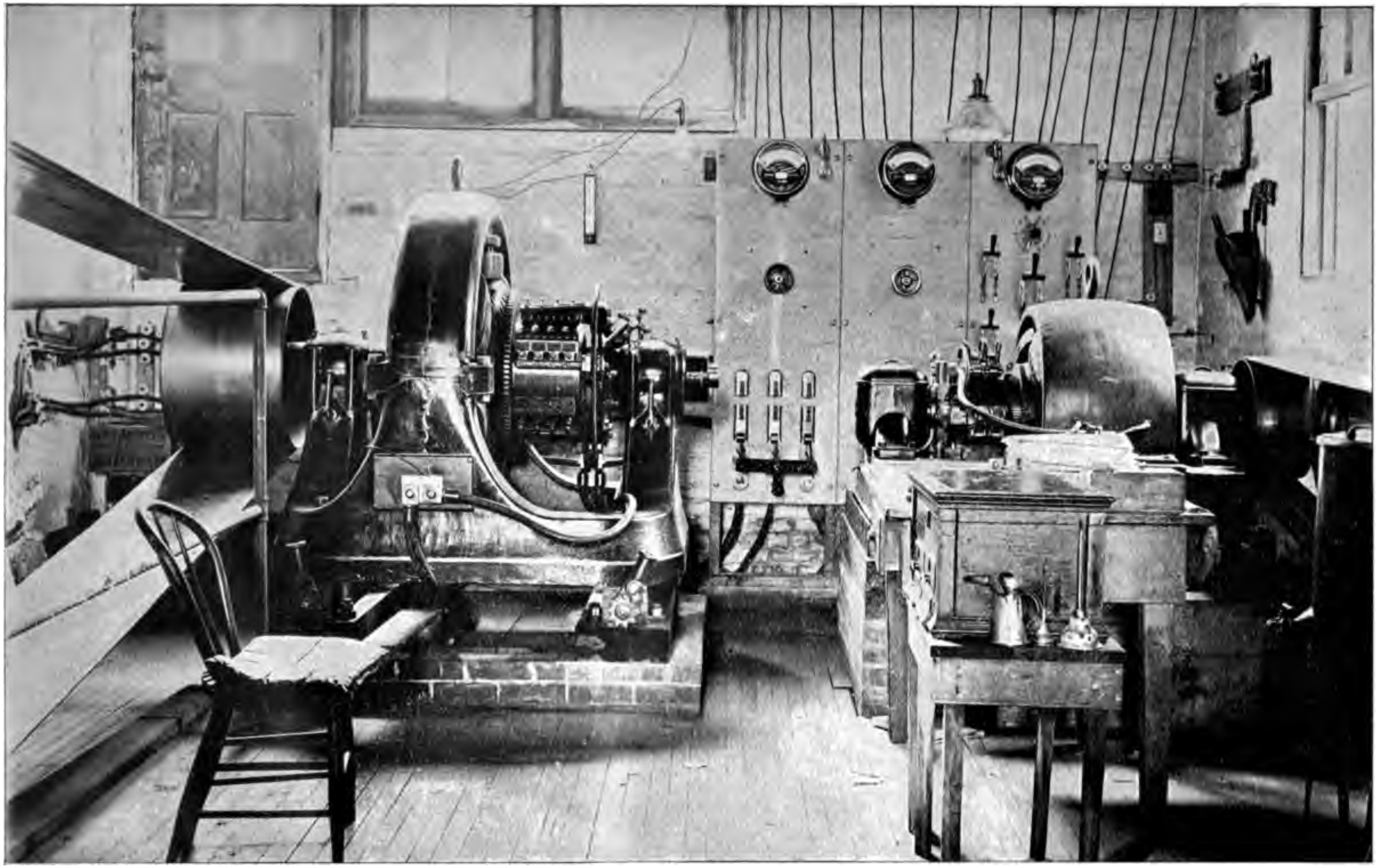


FIG. 6.—ELECTRICAL GENERATING PLANT OF THE HOME OF THE HONEY-BEES, 1899.

THE

A B C OF BEE CULTURE:

A Cyclopaedia of Every Thing

Pertaining to the Care of the Honey-Bee;

Bees, Honey, Hives, Implements, Honey-Plants, Etc.,

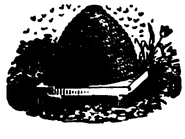
FACTS GLEANED FROM THE EXPERIENCE OF THOUSANDS OF BEE KEEPERS ALL OVER OUR LAND

And Afterward Verified by Practical Work in Our Own Apiary.

BY A. I. ROOT.

REVISED BY E. R. ROOT.

85th Thousand.



MEDINA, OHIO:

THE A. I. ROOT COMPANY.

1903.

To the
Throngs of eager, questioning Brothers and Sisters
In the Art of Bee Culture,
In Our Own and Other Countries,
This Work
Is Respectfully Dedicated by
THE AUTHOR.

1877 Preface.

In preparing this work I have been much indebted to the books of Langstroth, Quinby, Prof. Cook, King, and some others, as well as to all the bee-journals; but, more than to all these, have I been indebted to the thousands of friends scattered far and wide, who have so kindly furnished the fullest particulars in regard to all the new improvements, as they have come up, in our beloved branch of rural industry. Those who questioned me so much a few years ago are now repaying by giving me such long kind letters in answer to any inquiry I may happen to make, that I often feel ashamed to think what meager answers I have been obliged to give them under similar circumstances. A great part of this A B C book is really the work of the people, and the task that devolves on me is to collect, condense, verify, and utilize, what has been scattered through thousands of letters for years past. My own apiary has been greatly devoted to carefully testing each new device, invention, or process, as it came up; the task has been a very pleasant one; and if the perusal of the following pages affords you as much pleasure, I shall feel amply repaid.

Nov., 1877. A. I. Root.

1900 and 1903 Preface.

It is now over twenty-five years since the first copy of this work was put out. Little did A. I. Root dream, when he launched forth a volume bearing the modest title, A B C of Bee Culture, that it would run through so many editions. With each one it has been enlarged and revised until now the book aggregates 500 pages, and the number of copies printed reaches the large figure of 85,000, and the end is not yet. But during recent years the task of revising has almost entirely fallen to another. For more than ten years A. I. Root has had comparatively little to do with bees. Ill health, and interest in other matters, have caused him to drop bee culture so that of late years he has confined his writings aln entirely to other lines with which he is more actively connected. As a natural result, editorial work of *Gleanings in Bee Culture,* our illustrated semimonthly, so far as bee cul is concerned, and the re-writing of this book, have devolved on his son.

It is safe to say that the 1901 and the 1903 editions contain more new matter t previous ones, even exceeding that of the 1899 edition, which was so extensively revi: that 2000 copies were sold before it had actually come from the press.

There has been such a rapid advancement in bee culture it has been necessarv reviser, in most cases, to throw out whole subjects and re-write others entirely. the shorter ones, and especially those relating to honey-plants, have been left j they were written by A. I. Root himself over twenty years ago, and they are as u d now as they were then or ever will be. But all other subjects relating to metho devices, tools, bees and their manipulations, have been in most cases re-cast, and in the ot largely revised. Besides the extensive revisions, there have been a large number of subjects incorporated. These, together with the old subjects revised and rewritten, the A B C of to-day in every sense a new book, bearing the brand of 1903 from cover cover; and, what is of considerable importance, its teachings are adapted to every locality in the United States. The writer, having studied bee-keeping in nearly every State in the Union, has enc ored to i :e the book fit the North, South, East, and West.

So great h vanc ent that methods that were in vogue some twenty-five years ago hav d or g . While it is t for example, t

the extractors themselves have been greatly improved. During recent years the methods of queen-rearing and the manufacture of foundation have been revolutionized. Comb honey, while built in sections twenty years ago as now, yet the styles of supers, styles of sections, and styles of separators to-day are almost entirely different—so different that new systems of management are required. The patterns of hives of the present day as compared with those of former days are simpler in design, more expansive, more portable, and capable of greater speed in handling. Diseases that formerly were unknown have been discovered and named. The result of all these changes and advances in the industry is that three-fourths of the present volume is now the work of the writer and reviser.

ARTICLES WRITTEN BY A. I. ROOT.

Absconding Swarms, After-swarming, Age of Bees, Anger of Bees, Artificial Pasturage, Asters, Bee-bread, Blue Thistle, Borage, Catnip, Clover (Sweet and Crimson), Dandelion, Gill-over-the-ground, Goldenrod, Hybrids, Italianizing, Locust, Milkweed, Mustard, Propolis, Rape, Raspberry, Rocky-Mountain Bee-plant, Sourwood, Spider-plant, Sumac, Sunflower, Turnip, Uniting, Ventilation, Water, Whitewood.

ARTICLES WRITTEN BY E. R. ROOT.

Alfalfa (Lucerne), Artificial Fertilization, Anatomy of the Bee, Ants, Apiary (House Apiary), Artificial Comb, Barrels, Bees and Grapes, Bee Paralysis, Bees on Shares, Bleaching Comb Honey, Box Hives, Brood (Black and Pickled), Buckwheat, Buying Bees, Candy for Bees, Candied Honey, Comb Foundation, Comb Honey, Contraction, Diseases, Dividing, Entrances to Hives, Extractors, Fairs, Feeding and Feeders, Fixed Frames, Foul Brood, Frames (To Manipulate), Fruit-blossoms, Guajilla, Heartsease, Horsemint, Hives, Hoarhound, Honey, Honeys and Their Colors, Honey Adulteration, Honey-dew, Honey (Peddling), Introducing, Marigold, Mesquite, Nucleus, Overstocking, Poisoncus Honey, Queen-rearing, Record-keeping of Hives, Reversing, Skep, Smoke and Smokers, Spacing Frames, Spanish Needle, Spreading Brood, Tongue of Worker Bee, Transferring, Veils, Vinegar, Wax, Weight of Bees, Willows, Willow-herb, and some of the Biographies.

ARTICLES WRITTEN CONJOINTLY.

Basswood, Bee-hunting, Bee-moth, Bees, Clover, Drones, Dysentery, Enemies of Bees, Extracted Honey, Figwort, Honey-comb, Italian Bees, Hive-making, Laying Workers, Moving Bees, Pollen, Queens, Robbing, Sage, Stings, Swarming, Wintering.

ARTICLES WRITTEN BY DR. C. C. MILLER.

Honey as Food, Honey-plants, Out-apiaries, and many of the Biographies.

In order to give the identity of authorship, I have thought best to give here a list of the subjects written by A. I. Root; a list of those that have fallen to my lot to write, and also a list originally written by A. I. Root, which I have very largely re-written.

Medina, Ohio, Jan. 1, 1903. ERNEST R. ROOT.

[The small superior figures scattered through the body of the book (like this [141]) refer to comments of Mr. Doolittle or Dr. Miller in the back part of the book.]

Introduction.

About the year 1865, during the month of August, a swarm of bees passed overhead where we were at work; and my fellow-workman, in answer to some of my inquiries respecting their habits, asked what I would give for them. I, not dreaming he could by any means call them down, offered him a dollar, and he started after them. To my astonishment, he, in a short time, returned with them hived in a rough box he had hastily picked up, and, at that moment, I commenced learning my A B C in bee culture. Before night I had questioned not only the bees, but every one I knew, who could tell me anything about these strange new acquaintances of mine. Our books and papers were overhauled that evening; but the little that I found only puzzled me the more, and kindled anew the desire to explore and follow out this new hobby of mine; for, dear reader, I have been all my life *much* given to hobbies and new projects.

Farmers who had kept bees assured me that they once paid, when the country was new, but of late years they were of no profit, and everybody was abandoning the business. I had some headstrong views in the matter, and in a few days I visited Cleveland, ostensibly on other business, but I had really little interest in any thing until I could visit the bookstores and look over the books on bees. I found but two, and I very quickly chose Langstroth. May God reward and for ever bless Mr. Langstroth for the kind and pleasant way in which he unfolds to his readers the truths and wonders of creation to be found inside of a bee-hive.

What a gold-mine that book seemed to me, as I looked it over on my journey home! Never was romance so enticing; no, not even Robinson Crusoe; and, best of all, right at my own home I could live out and verify all the wonderful things told therein. Late as it was, I yet made an observatory-hive, and raised queens from worker-eggs before winter, and wound up by purchasing a queen of Mr. L. for $20.00. I should, in fact, have wound up the whole business, queen and all, most effectually, had it not been for some timely advice toward Christmas, from a plain practical farmer near by. With his assistance, and by the purchase of some more bees, I brought all safely through the winter. Through Mr. L., I learned of Mr. Wagner; shortly afterward he was induced to re-commence the publication of the *American Bee Journal;* and through this I gave accounts monthly of my blunders and occasional successes.

In 1867, news came across the ocean from Germany, of the honey-extractor; and [illegible] the aid of a simple home-made machine I took 100 lbs. of honey from 20 stocks, [illegible] increased them to 35. This made quite a sensation, and numbers embarked in the business; but when I lost all but 11 of the 35 the next winter, many said, "There! I [illegible] you how it would turn out."

I said nothing, but went to work quietly, and increased the 11 to 48, during the [illegible]son, not using the extractor at all. The 48 were wintered entirely without loss, [illegible] think it was, mainly, because I took care and pains with each individual colony. Fr[illegible] 48, I secured 6,162 lbs. of extracted honey, and sold almost the entire crop for [illegible] c [illegible] lb. This capped the climax, and inquiries in regard to the new industry began [illegible] from all sides; beginners were eager to know what hives to adopt, and wh[illegible] honey-extractors. As t[illegible] es in use s[illegible] d very poorly adapted to the use o[illegible] tractor, and as [illegible] for[illegible] e were heavy and poorly adapted to [illegible] besides being " [illegible] d [illegible] t [illegible] to [illegible] facture these i[illegible]

respondence that would occupy a great part of my time, without affording any compensation of any account.I The fullest directions I knew how to give for making plain simple hives, etc., were from time to time published in the *American Bee Journal;* but the demand for further particulars was such that a circular was printed, and, shortly after, a second edition; then another, and another. These were intended to answer the greater part of the queries; and from the cheering words received in regard to them, it seemed the idea was a happy one.

Until 1873, all these circulars were sent out gratuitously; but at that time it was deemed best to issue a quarterly at 25c per year, for the purpose of answering these inquiries. The very first number was received with such favor that it was immediately changed to a monthly, at 75c. The name given it was "GLEANINGS IN BEE CULTURE," and it was gradually enlarged until, in 1876, the price was changed to $1.00. During all this time, it has served the purpose excellently of answering questions as they come up, both old and new; and even if some new subscriber should ask in regard to something that had been discussed at length but a short time before, it was an easy matter to refer him to it, or send him the number containing the subject in question.

After GLEANINGS was about commencing its fifth year, inquirers began to dislike being referred to something that was published a half-dozen years ago. Besides, the decisions that were then arrived at perhaps needed to be considerably modified to meet present wants. Now, if we go over the whole matter again every year or two, for the benefit of those who have recently subscribed, we shall do our regular subscribers injustice, for they will justly complain that GLEANINGS is the same thing over and over again, year after year.

Now you can see whence the necessity for this A B C book, its office, and the place we purpose to have it fill. In writing it I have taken pains to post myself thoroughly in regard to each subject treated, not only by consulting all the books and journals treating of bee culture, which I have always ready at hand, but by going out into the fields, writing to those who can furnish information in that special direction, or by sacrificing a colony of bees, if need be, until I am perfectly satisfied. Still further: this book is all printed from type kept constantly standing; and as the sheets are printed only so fast as wanted, any thing that is discovered, at any future time, to be an error, can be promptly righted. For the same reason, all new inventions and discoveries that may come up—they are coming up constantly—can be embodied in the work just as soon as they have been tested sufficiently to entitle them to a place in such a work. In other words, I purpose it to be never out of date or behind the times.—December, 1878. A. I. ROOT.

The Home of the Honey-bees, and the Growth of the Bee-keeping Industry.

A glance at the frontispiece engravings, showing the buildings and the lumber-yards that go to make up the Home of the Honey-bees, covering over six acres of ground, gives some idea of the demands of bee-keepers; and when it is remembered that The A. I. Root Co.'s manufacturing plant is only one, notwithstanding it is largest of several, one can get some idea of the magnitude of the bee-keeping industry as a whole.

In one year's time there are made and sold anywhere from 40 to 60 millions of section honey-boxes in the United States alone. Estimating that there are about fourteen ounces of honey to each section sold, on the average, there is marketed annually in the United States something like 50 million pounds of comb honey; and as there is twice as much again of extracted produced as comb honey, the total aggregate would reach 100 to 125 million pounds of honey all told, or represent a money value of from 8 to 10 million dollars.

Perhaps it would be interesting to trace the development of just one manufacturing plant—a plant where every thing is made a bee-keeper can possibly require, all the way from a queen-cage to two, four, six, eight, and even twenty-five frame steam-power honey-extractors; bee-hives by the twenty-five thousands; smokers by the tens of thousands; perforated zinc by the thousands of square feet; sections by the tens of millions—making an aggregate of thousands of tons of freight every year.

As already explained in the Introduction, the nucleus of this enterprise was a swarm

of bees that went over the jewelry shop of A. I. Root in 1865. From this one swarm there developed a little apiary of some fifty or sixty colonies, and a bee-man who was destined to influence the whole bee-keeping world. This man began writing for the *American Bee Journal* under the *nom de plume* of "Novice;" and the result was, there came in inquiries from all over the United States, asking how to make hives, extractors, and where to get them. At that time there was no factory devoted exclusively to making bee-supplies in the world. But A. I. Root at his jewelry shop had a windmill, and pretty soon put in operation a buzz-saw which he hitched on to the mill; and well do I remember the time how we waited and waited for one of the most uncertain of all things—wind, just a little wind—to fill pressing orders for hives and other bee-keepers' appliances; also do I remember how we used to sleep in the shop, father and I, in order that we might be awakened by the rumbling of the shafting and creaking of the belting when the wind did come, so we could make hives by lamplight while the power lasted, for in those days it was not wise to wait till daylight, for the breeze might go down. Later a foot-power buzz-saw was purchased—yes, two of them—to "help us out." The orders began to come in until a 4½-horse-power engine was ordered; and if ever a youth reached the very height of his ambition it was when the writer of this, then a lad of about fifteen, was installed as engineer of the little engine. My! but didn't the buzz-saws whir? and didn't *we* get the goods off? By and by even the little engine began to groan under its load, for it had two buzz-saws and a planer to run, and it became necessary to run the little jewelry shop "up town" night and day; but this shop had been converted into a bee-hive establishment. It was easy to be seen that a new building would soon have to be erected near the depot, and so plans were laid for one 40x100, two stories and basement, metal roof. The old jewelry stock was sold out at auction, and the "up-town" store sold. The undertaking, involving the purchase of 18 acres of valuable land and the erection of so large a building, was tremendous for those days, and it nearly exhausted A. I. Root's good credit to pay his debts, and many were the speculations that he would "go under." But he did not. The 40-horse-power engine that had been installed, and the dozen or so buzz-saws, planers, etc., had all they could do to take care of the trade that had more than quadrupled. This was in 1880. The business continued to grow until it became necessary to add on a wing, 40x85 on the west end.

About this time the industry had begun to assume, as we then thought, massive proportions. Two shorthand writers were constantly employed, each one supplied with the latest improved typewriter. The business continued to grow at such a rate that the proprietor himself was almost demoralized by the mass of business that was poured down upon him.

Still the little bee seemed to be able to make a bigger stir than ever throughout the world, and in 1886 another building, 44x96, was added to the works. The old 40-horse-power engine was supplanted by a new and modern 90-horse-power automatic. Besides that, there was 250 feet of line shafting, with its attendant lot of machinery. Again, in 1888 the works had to be again enlarged: a smaller structure was put on. In 1889 another 60-horse-power steam-boiler was added, and a 90-foot smoke-stack, shown in Figs. 4, 5, and 6 of the frontispiece group. Besides this, a good deal of additional machinery was put in. Still again, in 1890 the trade had nearly doubled over former years, and we were compelled to extend our works by the addition of another brick building, two stories and basement, 37x98, see Figs. 3 and 4. In that same year other improvements were also introduced, such as electric lights, Grinnell automatic sprinklers, a huge fire-pump, and another large boiler. During that time an east and west railroad was also put through, close to our works—in fact, right through our grounds—thus bringing more and better shipping facilities. Again, in 1891 a three-story warehouse, in which to store goods, was erected. Four years later a third story was added to the wood-working building. See Figs. 4, 5, and 6. Still again, in 1896 a lumber-shed, covered with iron, 60x120, was put up. This building, the largest of the entire group, is of sufficient capacity to hold nearly a million feet of basswood lumber for making section honey-boxes; and yet, as large as it is, we have used all the lumber out of it inside of three months, just for section honey-boxes.

In 1897 we were obliged to run night and day, and yet we were not able to take all the trade by considerable. We had to refuse money-orders, and turn away a good deal of

other desirable trade. We hardly thought that, after such a heavy run of business, it would be necessary to run again nights; but in 1898 we were compelled to make double turns again, and for a much longer period of time, continuing clear up to the middle of July.

It became evident, by this time, that there would have to be a substantial enlargement, and more machinery, if we would keep up with our rapidly growing trade. Accordingly, during the latter part of 1898, we installed about $20,000 worth of improvements and enlargements—a 400-horse-power engine and a 400-horse-power boiler, the latter of the new water-tube type, a 135-horse-power electric-transmission equipment, the latter to carry power to distant points in our manufacturing plant. This, together with the electric apparatus that we already had in, made an investment in electric equipment of something like $4000. The entire outfit comprises two dynamos, one of 100 horse-power, and the other 35. There are scattered over our plant 21 different electric motors, all operated by the two dynamos referred to, or what is technically called "generators." The machinery immediately adjacent to the big engine is operated by belting and shafting, so that, all in all, we now have one of the latest and best equipped power plants of its size that can be found in the world.

All of this necessitated the rebuilding and enlarging and remodeling of the engine and boiler rooms. An annex, operated entirely by electricity, was also put on to the end of one of the big buildings, the sole purpose of which was to take in the big planer, costing $1000, and some other special machinery.

Something like a dozen clerks are employed almost constantly in our main home office in taking care of the general business, answering letters, keeping the books, and doing general office work. From three to four stenographers are required to take dictation from the members of the firm; and six typewriters are kept in use the greater part of the time.

There are scattered over the various portions of the United States five branch offices under the name of "The A. I. Root Co." Besides this there are something like fourteen or fifteen large agencies that handle goods by the carload, to say nothing of smaller agencies that handle supplies in smaller quantities. All these branch offices and agencies keep in close touch with the home office.

In 1894, the business having grown so large, the management was transferred to a stock company—The A. I. Root Co.—having a paid-up capital of $100,000, with A. I. Root, the founder, as President; E. R. Root as Vice-President; J. T. Calvert, a son-in-law of A. I. Root, Treasurer; and later, A. L. Boyden, another son-in-law, was chosen Secretary.

At the time the change went into effect, no new policy was brought forth. In fact, the business is now managed the same as before, and by the same men. A. I. Root having dropped a good many of the active duties, partly from ill health and partly because his attention was taken up with other matters, the general management and conduct of the business devolves upon "the boys." J. T. Calvert, business manager, has general supervision of the manufacturing departments; is general purchasing agent—in short, has general charge of the commercial part of the business. A. L. Boyden, Secretary, assists Mr. Calvert, besides giving his special attention to the general office work, keeping in touch with the branch offices and agencies scattered throughout the United States. E. R. Root, Vice-president, is editor of *Gleanings in Bee Culture,* and with the other two men has his share of the correspondence. He also has more or less to do with fixing the style of goods that shall be put out from season to season.

In closing I can do no better than to give here a paragraph that may prove helpful to some blundering boy whose plans will not work. This is what A. I. Root, the founder of the institution, has to say:

"Now, dear reader, I do not know how it seems to you; but when I take a look at the scene of activity as shown in the engravings of the Home of the Honey-Bees just preceding it seems to me almost as if it could not be reality. It was only a very short time ago that I was a blundering boy—yes, a boy who cried over his plans because they did not work just as he had figured out they ought to work. When this blundering boy, however, stopped working for himself, and began working for the kingdom of God and his glory, giving employment to those who seemed to be in sad need of it, etc., then, by some strange process, success seemed to crown his humble efforts. It seemed as if some great and

mighty power had the control and management; and who shall say that such has not been the case while the motto stjll remains, cut in the solid sandstone right over the arch, in the center of the main building—'*In God we trust*'?"

Thus far I have made no mention whatever of our journal, *Gleanings in Bee Culture*, an illustrated semimonthly magazine of some 36 pages. In each issue there are a number of half-tone engravings direct from photographs, which show the various stages of the industry from A to Z. Many of these have been incorporated into this work; but after one has gotten well into the body of the book, and has begun to understand the main principles, he will still need the journal to help him in his work, for it will save him many times its cost every year.

Jan., 1903. E. R. Root.

" A GOOD CATCH."

Photograph by W. Z. Hutchinson

A.

[*Note.*—Strangely enough, some of our A B C scholars have attempted to take up each subject in this work in its consecutive order. As this is a cyclopedia on bee culture it should no more be read in this manner than a dictionary or any cyclopedia. As a guide to the beginner I would suggest that he take for his course of reading the following subjects in the order named: BUYING BEES; HIVES; APIARY; TRANSFERRING; STINGS; ROBBING; FEEDING; SWARMING, and ABSCONDING OF SWARMS; COMB HONEY; EXTRACTED HONEY; QUEENS; QUEEN-REARING; UNITING; WINTERING. Other subjects may be taken up as deemed best, for then the learner will be able to read any thing in the book understandingly.][306]

ABSCONDING SWARMS.—Perhaps nothing is more aggravating in bee culture than to have our bees all on a sudden "light out" for parts unknown, without so much as stopping to give us a parting word of farewell, or a single token of recognition of the debt they owe us, in the shape of gratitude for our past kindnesses in providing them with a home, shelter, etc. Perhaps no part of animated creation exhibits a greater love of home than does the honey-bee; no matter how humble or uninviting the surroundings, bees seem much attached to their home; and as they parade in front of their doorway after a hard day's work,[3]* plainly indicate that they have a keen idea of the rights of ownership, and exhibit a willingness to give their lives freely, if need be, in defense of their hard-earned stores. It is difficult to understand how they can ever be willing to abandon it all, and with such sudden impulse, and common consent. No matter if they have never seen or heard of such a thing as a hollow tree, but have for innumerable bee generations been domesticated in hives made by human hands, none the less have they that instinctive longing that prompts them to seek the forest as soon as they get loose from the chains of domestication. It is possible that the bees, as they go out foraging, keep an eye out for desirable places for starting new homes, and it may be that they have the hollow trees picked out some time before they decide to leave. Many incidents have been reported that pretty clearly show this to be the case. We once found our bees working strongly on a particular locality about a mile and a half from the apiary, where the white clover was blooming with most unusual luxuriance. Very soon after, a colony swarmed, and the bees, after pouring out of the hive, took a direct line for a tree in this clover-field, without so much as making any attempt to cluster at all. Did they not figure out the advantage of having only a few rods instead of over a mile to carry their honey, after having patiently gathered it from the blossoms, little by little? Perhaps it will be well to remark here, that it is very unusual for a swarm to go to the woods without clustering; the bees usually hang from 15 minutes to an hour, and many times several hours; in fact, I have known them to hang over night; but perhaps it would be well to take care of them inside of 15 or 20 minutes, if we would make sure of them. Long before swarming-time, hives should all be in readiness, and they should also be located near where the new colony is to stand. If one is going to have a model apiary, he should not think of waiting until the bees swarm before he lays it out, but take time by the forelock, and with careful deliberation decide where every hive shall be before it is peopled with bees, if he would keep ahead and keep his bees from taking "French leave."

But they sometimes go off, even after they *have* been carefully hived, some will say. We are well aware they do often go off after being hived, sometimes the same and sometimes the next day; but are we sure the hiving was carefully done? I never feel satisfied unless I have given the new swarm at least one comb containing unsealed brood, and I have seldom had a swarm desert a hive when thus furnished, nor do I often hear of one's doing so. With such hives as we shall describe, it is a very simple task, and takes but a minute to open a hive and get such a comb. And, besides, if by any chance one should fail to get the queen when he hives the swarm, it would be supplied with the means of rearing another.

This plan of giving the bees unsealed brood does very well if one can get them into the hive, but it is necessarily somewhat like the one of catching birds with a handful of salt; how are we to obviate losing the occa-

*Whenever these small figures occur, the reader is requested to turn to Doolittle's and Miller's comments at the close of this book.

sional swarm that goes off without clustering at all? or the quite frequent cases of coming out unobserved, or when no one is at home? I am happy to say there is a very certain and sure remedy for all cases of first swarming, in having the wings of the queen clipped so she can not fly; this plan is in very general use, and answers excellently for all first swarms; but, alas! the after-swarms are the very ones that are most apt to abscond, and we can not clip the wings of *their* queens, because they have not yet taken their wedding-flight. What shall we do? Candidly, I don't know of any better way than to watch carefully when they are to be expected, and then chase after them, climb trees, etc., until they are once got safely into a hive. If one thinks this too much trouble, he should prevent having after-swarms as I advise under that head.

Clipping the wings of the queen prevents losing first swarms by absconding, it is true; but it does not always prevent losing the queen. She goes out with the bees as usual, and, after hopping about in front of the hive, sometimes gets ready to go back at about the same time that the bees do, after having discovered she is not in the crowd. Even if she gets some little distance from the hive, the loud hum they make as they return will guide her home many times; but unless the apiarist is at hand at such times to look after affairs, many queens will be lost,[6] and the bees will rear a lot of young queens, and go into after-swarming in good earnest, making even the first swarm an "after-swarm." A German friend, who knows little of bee culture, once told me my bees were swarming, and if I did not ring the bells, etc., they would certainly go to the woods. As I quietly picked up the queen in passing the hive, I told him if they started to go away, I would call them back. Sure enough, they did start for the woods, and had gone so far that I really began to be frightened myself, when, away in the distance, we saw them suddenly wheel about, and then return to the hive at our very feet. While he gave me credit of having some supernatural power over bees, I felt extremely glad I had taken precautions to clip all our queens' wings but a few days before. After this, I felt a little proud of my control over these wayward insects, until a fine swarm of Italians started off under similar circumstances, and, despite my very complacent, positive remarks, to the effect that they would soon come home, they went off and stayed "off." In a humbler, and, I dare say, wiser frame of mind, I investigated, and found they had joined with a very small third swarm of black bees, that had just come from one of a neighbor's hives. I tried to "explain," but it required a five-dollar bill to make matters so clear that I could carry back my rousing swarm of yellow bees, and sort out the black unfertile queen, that they might be made to accept their own. Thus you see, my friends, how many a slip there is, in bee culture, between cup and lip, and how very important it is that you keep posted, and also "post" yourself in some conspicuous place near or in the apiary if you allow natural swarming, and do not want your golden visions—and bees—to take to themselves wings and fly away.

ABSCONDING FOR WANT OF FOOD.

Perhaps bees oftener desert their hives because they are short of stores than from any other cause; and many times, in the spring, they seem to desert because they are nearly out. The remedy, or, rather, preventive, for this state of affairs, is so plain that I hardly need discuss it. After they have swarmed out, and are put back into the hive, I would give a heavy comb of sealed stores if I could; if not, I would feed them a little at a time, until they have plenty, and I would be sure that they have brood in the combs. If necessary, I would give them a comb of unsealed larvæ from some other hive, and then feed them until they have a great abundance of food. One should be ashamed of having bees abscond for want of food.

ABSCONDING IN EARLY SPRING.

This seems to occur just at a time when we can ill afford to lose a single bee; and, worse still, only when our stocks are, generally, rather weak, so that we dislike the idea of losing any of them. In this case they do not, as a general thing, seem to care particularly for going to the woods, but rather take a fancy to pushing their way into some of the adjoining hives, and, at times, a whole apiary will seem so crazy with the idea as to become utterly demoralized.

A neighbor, who made a hobby of small hives—less than half the usual size—one fine April day had as many as 40 colonies leave their hives and cluster together in all sorts of promiscuous combinations. To say that their owner was perplexed, would be stating the matter very mildly.

Similar cases, though perhaps not as bad, have been reported from time to time, ever since novices commenced to learn the science of bee culture; and although cases of

swarming out in the spring were known once in a great while before the recent improvements, they were nothing like the mania that has seemed to possess entire apiaries—small ones—since the time of artificial swarming, honey-extractors, etc. I would by no means discourage these improvements, but only warn beginners against making too much haste to be rich. I would not commence dividing my bees until they are abundantly strong. They should go into winter quarters with an abundance of sealed honey in tough old combs as far as may be; and should have hives with walls thick and warm, of some porous material, such as chaff or straw, with a good thickness of the same above, and we will have little cause to fear any trouble from bees absconding in the spring.

ABSCONDING NUCLEUS SWARMS.

This, like the above, seems an outgrowth of the artificial system of working with bees, especially the plan of rearing queens in nuclei formed of two or three frames five or six inches square. This small-hive system was much in vogue about the year 1865. For a while all worked finely; but soon complaints began to be heard that the bees left their hives in a body, with the queen, whenever she attempted to take her flight to meet the drones. Giving them unsealed larvæ, to amuse and console themselves with while she was absent, was then advised, and it answered very well for a time; but eventually one after another began to declare they wanted no frame in the apiary for queen-rearing, smaller than the ordinary brood-frame. Since this, but little has been heard in the way of complaints of this kind of absconding. Where one has the time to study these little colonies, there is something very interesting and amusing about them. We have had them do finely for several weeks, with perhaps no more than a good pint of bees. A good day's work during clover-bloom would fill the hive completely, and the young queen, after commencing to lay, would often fill the combs by her second day's work; then if she turned up missing on the third day, we used to wonder what in the world was the matter. Sometimes these little swarms would be found hanging on a currant or raspberry bush, as quietly and demurely as if that was the way bees always did; at other times, when we had hunted

AFTER THE ABSCONDER.

—New South Wales Agricultural Gazette.

through all available places for a truant colony, and given them up in despair, they would come circling back and cluster quietly almost under our very (inexperienced) noses.

There is still another kind of absconding that seems to be for no other reason than

that the bees are displeased with their hive, or its surroundings, and, at times, it seems rather difficult to assign any good reason for their having suddenly deserted. I have

A SMALL AFTER SWARM.

known a colony to swarm out and desert their hive because it was too cold and open, and I have known them to desert because the combs were soiled and filthy from dysentery in the spring. They very *often* swarm out because they are out of stores, and this generally happens about the first day in spring that is sufficiently warm and sunny. I have known them to swarm out because their entrance was too large, and, if I am not mistaken, because it was too small. I have also known them to swarm out because

they were so "pestered" with a neighboring ant-hill—see ANTS—that they evidently thought patience ceased to be a virtue.

They often swarm out in spring where no other cause can be assigned than that they are weak and discouraged, and in such cases they usually try to make their way into other colonies. While it may not always be possible to assign a reason for such behavior with medium or fair colonies, we may rest assured that good strong colonies, with ample supplies of sealed stores, seldom, if ever, go into any such foolishness.

By way of summing up, it may be well to say: If you would not lose your bees by natural swarming, clip the wings of all queens as soon as they commence laying; then look to them often, and know what is going on in the apiary every day during the swarming season; if you would not have runaway swarms in the spring, and while queens are being fertilized, confine your experiments to pecks of bees instead of pints.

ADULTERATION OF HONEY. See HONEY ADULTERATION.

AFTER-SWARMING.—We might define this by saying that all swarms that come out, or are led out by a VIRGIN QUEEN, are termed after-swarms; and all swarms that come out within eight or fifteen days after the first swarm, are accompanied by such queens. There may be from one all the way up to a half-dozen or even more, depending on the yield of honey, amount of brood or larvæ, and the weather; but whatever the number, they are all led off by queens reared from one lot of queen-cells, and the number of bees accompanying them is, of a necessity, less each time. The last one frequently contains no more than a pint of bees, and, if hived in the old way, would be of little use under almost any circumstances; yet when supplied with combs already built and filled with honey, such as every enlightened apiarist should always keep in store, they may be made the very best of colonies, for they have young and vigorous queens, and often are equal to any in the apiary, the next season.

There is one very amusing feature in regard to these after-swarms. When they have decided to send out no more swarms, all the young queens in the hive are sent out, or, it may be, allowed to go out with the last one; and every few days during the swarming season, some "new hand" writes us about the wonderful fact of his having found three or four, or it may be a half-dozen queens in one swarm.[8] On one occasion, a friend, who weighed something over 200, ascended to the top of an apple-tree during a hot July day to hive a very small third swarm. He soon came down, in breathless haste, to inform us that the swarm was *all queens;* and, in proof of it, brought two or three in his closed-up hands.

Years ago after-swarming was considered a sort of necessary evil that had to be tolerated because it could not be obviated; but in no well-regulated apiary should it be allowed. It is good practice to permit one swarm—the first one. After that all others should be restrained. Cutting out all the queen-cells but one may have the effect of preventing a second swarm; but the practice is objectionable—first, because one *can not be sure* that he destroys all but one. If there are two cells the occupant of one of them, when she hatches, is liable to bring out an after-swarm; indeed, we may say that, as long as there are young queens to hatch, there is *liable* to be an after-swarm up to the number of three or four, and possibly five.

But the practical honey-producers of to-day consider cell-cutting for the prevention of these little swarms as waste of time. The plan usually adopted is about as follows:

The wings of all queens in the apiary should be clipped, or else there should be entrance-guards over the colonies. As soon as the first swarm comes forth, and while the bees are in the air, the queen, if clipped, is found in front of the entrance of the old hive. She is caged, and the old hive is lifted off the old stand, and an empty one containing frames of foundation or empty combs is put in its place. A perforated zinc honey-board is next put on top, after which the supers, now on the old stand. The queen in her cage is placed in front of the entrance, and the old hive is next carried to an entirely new location. In the mean time the swarm returns to find the queen at the old stand; and when the bees are well started to running into the entrance she is released, and allowed to go in with them. Most of the old or flying bees that happen to be left in the old colony, now on the new location, will go back to the old stand to further strengthen the swarm. This will so depopulate the parent colony that there will hardly be bees enough left to cause any after-swarming, and the surplus of young queens will have to fight it out among themselves—the "survival of the fittest" being, of course, the only one left. She will be mated in the regular way, and

the few bees with her will not, of course, follow her, as there will not be enough of them to make a respectable after-swarm.

By this plan there is no hunting of queen-cells. The first young queen that hatches may, as soon as she begins to feel that she is mistress of the home, destroy other cells; or if not, and the young queens hatch, she may fight it out with them.

HEDDON'S METHOD OF PREVENTING AFTER SWARMS.

Another plan that is practiced to some extent is what is called the Heddon. The first swarm is allowed to come forth; and during the time it is in the air the parent colony is removed from its stand, and placed a few inches to one side, with its entrance pointing at right angles to its former position. For instance, if the old hive faced the east, it will now look toward the north. Another hive is placed on the old stand, filled with frames of wired foundation. The swarm is put in this hive, and at the end of two days the parent hive is turned around so that its entrance points in the same direction as the hive that now has the swarm. Just as soon as young queens of the parent colony are liable to hatch it is carried to a new location during the middle of the day or when the bees are flying the thickest. The result is, these flying bees will go back to the hive having the swarm. This, like the other method described, so depletes the parent hive that any attempt at after-swarming is effectually forestalled, and the process of sifting out the survival of the fittest queen takes place.[307]

AGE OF BEES.—It may be rather difficult to decide how long a worker bee would live, if kept from wearing itself out by the active labors of the field; six months certainly, and perhaps a year; but the average life during the summer time is not over three months, and perhaps during the height of the clover-bloom not over six or eight weeks. The matter is easily determined by introducing an Italian queen to a hive of black bees, at different periods of the year. If done in May or June, we shall have all Italians in the fall; and if we note when the last black bees hatch out, and the time when no black bees are to be found in the colony, we shall have a pretty accurate idea of the age of the blacks.[14] The Italians will perhaps hold out under the same circumstances a half longer. If we introduce the Italian queen in September, we shall find black bees in the hive until the month of May following—they may disappear a little earlier, or may be found some later, depending upon the time they commence to rear brood largely. The bees will live considerably longer if no brood is reared, as has been several times demonstrated in the case of strong queenless colonies. It is also pretty well established that black bees will live longer in the spring than Italians; probably because the latter are more inclined to push out into the fields when the weather is too cool for them to do so with safety; they seldom do this, however, unless a large amount of brood is on hand, and they are suffering for pollen or water.

During the summer months, the life of the worker-bee is probably cut short by the wearing-out of its wings, and we may, at the close of a warm day, find hundreds of these heavily laden, ragged-winged veterans making their way into the hives slowly and painfully, compared with the nimble and perfect-winged young bees. If we examine the ground around the apiary at nightfall, we may see numbers of these hopping about on the ground, evidently recognizing their own inability to be of any further use to the community. We have repeatedly picked them up, and placed them in the entrance, but they usually seem only bent on crawling and hopping off out of the way, where they can die without hindering the teeming rising generation.

AGE OF DRONES.

It is somewhat difficult to decide upon the age of drones, because the poor fellows are so often hustled out of the way, for the simple reason that they are no longer wanted; but we may be safe in assuming it is something less than the age of a worker. If kept constantly in a queenless hive, they might live for three or four months perhaps.[15]

AGE OF THE QUEEN.

As the queen does little or no out-door work, and is seldom killed by violence as are the drones, we might expect her to live to a good old age, and this she does, despite her arduous oviparous duties. Some queens die, seemingly of old age, the second season, but generally they live through the second or third, and we have had them lay very well even during the fourth year. They are seldom profitable after the third year, and the Italians will sometimes have a young queen "helping her mother" in her egg-laying duties, before she becomes unprofitable.

If a very large amount of brood is found in a hive, two queens will often be found,

busily employed, and this point should be remembered while seeking to introduce valuable queens.

ALFALFA, OR LUCERNE (*Medicago sativa*). This one of the clovers is very closely related to, and indeed greatly resembles, sweet clover, which latter is described under the head of CLOVER. Alfalfa has, during late years, come to be one of the most important honey-plants of the great West—especially of those arid regions that have to be irrigated. It is grown most extensively in Colorado, Wyoming, Arizona, Nevada, Utah, Kansas, Nebraska, New Mexico, Washington, Oregon, and is now making rapid strides in California.

METHOD OF STACKING ALFALFA HAY.

It has been grown, in an experimental way, in many of the Eastern States; but outside of irrigated regions, and some parts of the West not irrigated, it is not known to yield any honey. While it makes an excellent forage plant in a few localities in the East, permitting of one or two cuttings, it is grown as a hay, particularly in the Western States I have mentioned; for there is no other forage-plant that will yield the same tonnage per acre of fodder or hay in the regions that have to be irrigated. It yields anywhere from 3 to 5 tons per acre, and gives from 3 to 5 cuttings to the season, and, under favorable circumstances, it is even claimed that 6 and 7 have been made. For the best hay it should be cut when the blooming commences; but, unfortunately for the bee-keeper, this also cuts off the supply of nectar when it is flowing at its very best; for alfalfa, when in bloom in the irrigated regions, is perhaps the greatest honey-plant in the world. But notwithstanding the interests of the bee-keeper, the ranchers cut their alfalfa just as soon as it begins to bloom, irrespective of the fact that it is "killing the goose that lays the golden egg" for the bee-keeper. After cutting, it is stacked in the open field* in a stack that will run anywhere from 10 to 100 tons in capacity.

As one goes through the irrigated regions of Arizona, California, Idaho, Utah, and Colorado, in a Pullman car going at the rate of 50 or 60 miles an hour, he sees hundreds and hundreds of such stacks; and where one stack has been cut into, or opened up, he sees not the dull grayish-brown hay of the East, but a beautiful grass-green clover hay; and it seems to keep green, no matter how old it is, provided it is not faded out by the intense sunlight that pours down with such relentless fury on the Great American Desert. But it is only the top layers that are faded. A few inches below, the hay is of the beautiful green color I have described.

The irrigation needed to grow it for forage makes the crop almost certain; and those bee-keepers who are located in the vicinity of alfalfa-growing can rely almost as certainly on a crop of honey, the very finest, richest, thickest in the world. Of all the honey I have ever tasted I know of nothing, not even clover (which has formerly held the first rank), that can equal it. It runs from 12 to 13 lbs. to the gallon, while most eastern honeys run from 11 to 12 lbs. This heaviness of body is due to the dryness of the atmosphere in which it grows; for where alfalfa flourishes at its best, hives made of the best seasoned white pine will shrink and twist and check in a manner that is truly astonishing to a "tenderfoot." A light dry

*In the irrigated regions it scarcely ever rains, and therefore great barns for the storage of the hay are not necessary.

atmosphere a mile above the level of the sea, in the regions of Denver, almost entirely devoid of dews and frosts, a cloudless sky, occasional hot winds, a bright sun that pours down, unobstructed by cloud or mist, causes every thing to dry up, and even honey to

Plate I.

THE CELEBRATED ALFALFA PLANT AND ROOT.

The plant represented in this plate grew in a rich, loose soil, with a heavy clay subsoil and an abundant supply of water, the water level ranging from 4 to 8 feet from the surface at different seasons of the year. The diameter of the top was 18 inches, and the number of stems 380. The plate shows how these crowns gather soil around them, for the length of the underground stems is seen to be several inches, and this represents the accumulation of nearly this much material about it.

This is one of the largest plants that I have yet found. The specimen, as photographed, was dug April 30, 1896.—*Dr. Headden, in Bulletin No. 35, "Alfalfa."*

thicken—so much so that it is difficult to throw it out of the combs with the best of extractors. Indeed, I found that some bee-keepers are obliged to place their extractors in warm rooms, and even warm the combs sometimes before extracting, so thick is the honey. And then to do any thing like a good job of extracting one must give the extractor-baskets a high rotative speed, and this necessarily puts a great strain on the wire cloth and the bracing of the extractor.

I have already spoken of the superb quality of alfalfa honey. If every one takes a liking to it, as I have done, he will be almost spoiled for eating any other honey. Some of it is so thick and fine that it can be almost chewed like so much delicious wax candy. The flavor is a little like that of white clover, with a slight trace of mint that is very pleasant.[308] In color it is quite equal to it, and in every other way it has no superior, although in some parts of the West the color is on the amber order. In the very hot portions of the United States it is inclined to be darker than in the colder localities. The Colorado alfalfa is as a rule the lightest.

The nectar from alfalfa is secreted so abundantly during the time it is in bloom that anywhere from 100 to 500 colonies can be supported in a given location. In Colorado, however, it is found more profitable to have apiaries containing no more than from 100 to 150 colonies, owing to the very great overstocking in many of the best localities. Bee-keepers have rushed to this land of gold and golden honey in such numbers that in the great alfalfa-growing regions apiaries are stuck in very closely, from half a mile to a mile apart, so it is not now profitable to have more than 100 colonies to the yard. In other localities not so much overstocked, from 200 to 300 colonies can be kept in a single apiary.

For a given acreage there is no plant or tree, unless it is basswood, that will support as many colonies. In several localities in Colorado and Arizona, within a radius of five miles, there will be anywhere from two to seven thousand colonies, the like of which can not be found anywhere else in the world, probably.

There is scarcely a prettier sight than alfalfa when in bloom. The beautiful bluish or violet tinted flowers present a mass of color that is truly striking to one who has never seen the like of it before; and the fields are measured, not by the acre, but by the square mile. Indeed, I rode through one ranch in a Pullman car, going probably 50 miles an hour, that seemed all of 40 minutes in going through it—not acres, but miles and miles of it as far as the eye could reach on each side of the track; and stacks and stacks of it, aggregating 100 tons to the pile, more than one could count if he were to try. Imagine, if you please, the effect of seeing such a field all in bloom, and mowing-machines going through it cutting it down. Imagine, too, the happy hum of the bees going to and from these immense fields. Then, truly, is the harvest of the rancher and bee-keeper.

No time is lost. The rancher is eager to get the whole cut as *soon as possible*. The bee-keeper, on the other hand, hopes that his rancher co-laborer may make as *slow* work as possible; for as the mowing-machines go through the field, the bee-keeper sees a gradual decrease in the flow of nectar. At the rate the mowers are progressing he can tell to a day when the hay will all be cut, and when the honey or the nectar will cease to flow. In producing comb honey he supplies his colony with just enough sections so the bees may fill every one of them at the close of the honey-flow which he knows in advance to a day. When the hay is all cut, then he awaits the new growth, the new bloom, and then, again, there is a scramble for honey on the part of the bee-keeper and the bees, and another scramble to get the hay down before it grows to be too old or out of bloom.

There is a growing tendency of late for the ranchmen in some localities to cut the hay *before* it comes into bloom. It is claimed that the early cutting makes a better quality of hay. However that may be, if the practice should become universal one of the greatest honey-plants of the world will be cut off from the bees. In any case, fortunate is that bee-keeper who is located in the vicinity of those alfalfa-fields devoted to the growing of alfalfa *seed;* for all such have the benefit of the entire blooming until the flower fades and the seed-pod takes its place. It is in these regions especially that a large number of colonies per yard can be supported.

Most of the best alfalfa-fields in Colorado have been taken by bee-keepers; and unless one can take a range vacated by another by death or otherwise, or get it by purchase, it is a matter of common honor that the new comer should keep out; still, there are some who will squeeze in just a few colonies and gradually encroach upon the territory until there is not much in it for any one.

APPEARANCE OF THE ALFALFA.

To a "tenderfoot," or one from the East, alfalfa looks a good deal like sweet clover; and when the two plants are young it takes even an expert to detect the difference; but as they grow older the alfalfa assumes more of a heavy bushy character; and the other, sweet clover, takes on more the appearance of a treelike weed.

CULTIVATION OF ALFALFA.

While it seems to grow best in the arid regions watered by irrigation-ditches, it also grows in localities where there is not too much rainfall or the soil is not too wet. It seems to do best on a light sandy soil with a loose or porous subsoil, and the roots run for 4 to 12 feet down—on the average perhaps 5 or 6 feet. The seed may be sown broadcast or in drills about 12 inches apart. The amount per acre varies greatly. Some think that 10 lbs. is sufficient, while others argue in favor of 30 lbs. The average amount seems to be from 15 to 20 lbs. If too small an amount of seed is sown, the plants grow large and coarse; whereas if a larger amount were used, a larger number of plants result in smaller stems and better hay.

Alfalfa is what is called a perennial--that is, it lives on from year to year, and the great difficulty of growing it in the East is to get it to make a stand. If it can be once started it will grow on from year to year with very little trouble.

The average life of the plants under ordinary conditions seems to be about twelve years, although some claim they will live as long as fifty years; but good authorities seem to doubt the statement.

For some of the data just given, and for the half-tone illustration shown on page 8, I am indebted to Bulletin No. 35, entitled "Alfalfa," from the State Agricultural College, Fort Collins, Col., by Dr. W. P. Headden, Chemist.

ANATOMY OF THE BEE. Although I have spent much time with the microscope in dissecting the bee and studying its wonderful structure, yet for the main facts of this article I am indebted to that admirable little scientific work, "The Honey-bee," by Thos. Wm. Cowan, a microscopist and scientist of the front rank, as well as editor of the *British Bee Journal*. Mr. Cowan is so careful and guarded in his conclusions, and so well posted as to the results of the investigations of other eminent microscopists, that I have no hesitancy in accepting his statements. All I shall endeavor to do is to put the material in a condensed and popular form, with a few side-lights thrown in from other sources.

I will first call your attention to the alimentary canal—that is, the organs of digestion and assimilation. What is digestion? Our author says, "It is the separation of the nutrient part of food from the non-nutrient, and the conversion of the nutrient into a liquid fit to mingle with the blood, and thus nourish the body of the insect." We all know how the bee gathers up its food through its wonderful and delicate little tongue.[311] It then passes into a little tube just below the point *a*, in the engraving, called the "œsophagus," or "gullet." We find a similar organ in our own bodies, leading from the mouth and communicating directly with the stomach. This œsophagus passes through the waist of the bee, or thorax, as it is called, and to the honey-stomach *g* in the abdomen. It is in this little sac, although it can hold but a tiny drop at a time, that millions and millions of pounds of nectar are carried annually and stored in our combs. This sac *g* is located in the fore part of the abdomen.

Several years ago I had a curiosity to know what the bees were working on. I suspected that they were gathering juices from over-ripened raspberries on the vines. In order to satisfy myself I grasped a bee by its waist and abdomen, and pulled until the parts were separated, and then was revealed the little honey-sac, which had disengaged itself from the abdomen. This contained a light purple or wine-colored liquid. The size of this honey-sac, as nearly as I can recollect now, was a good big eighth of an inch; and I should judge that the bee had all it could contain in its little pocket. Cheshire says that, when the honey-sac is full, it is $\frac{1}{7}$ of an inch in diameter. This would agree with my observations.

STOMACH-MOUTH.

The next thing that engages our attention is a sort of valve, which has been called the stomach-mouth, and is located between the honey-stomach and the true stomach; viz., at *h*. This is one of the most interesting of organs; and I suppose that no part of the internal anatomy of the bee has been more studied, theorized about, dissected, and examined, than this deli ate and beautiful little valve. At *h* its true structure does not appear. It has been likened in appearance to a bud just about to open. It is a

 ANATOMY OF THE BEE.

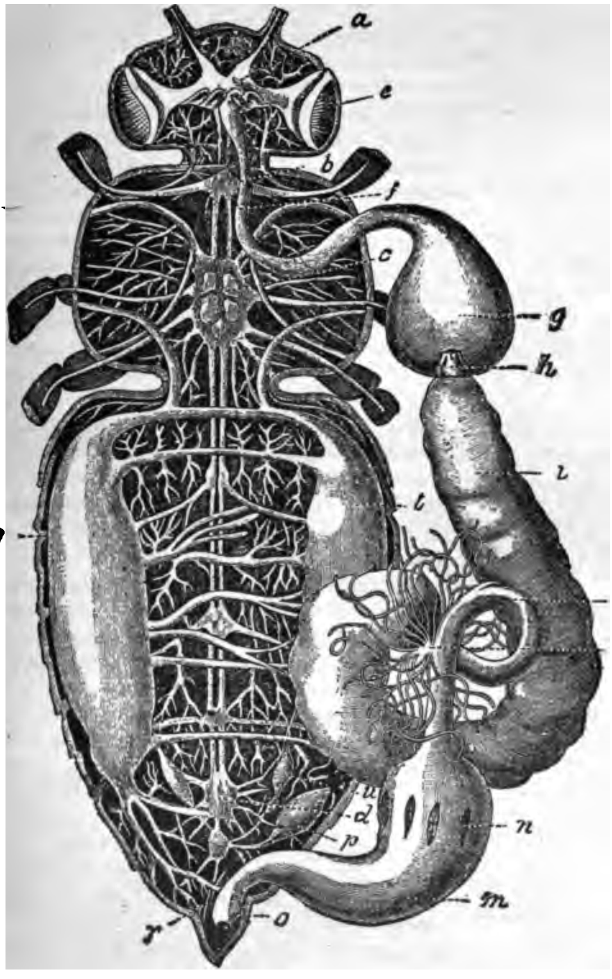
sort of valve, fringed on the inside with rows of bristles, or hairs, the object of which seems to be to separate the pollen grains from the nectar, the former passing into the stomach *i*.[313]

TRUE STOMACH.

This corresponds to the stomach in our own bodies, and performs the same function in the way of digestion in converting the nutrient particles of the food into blood. The inside walls of the stomach have certain cells which perform certain offices; but without more definite engravings it will be impossible to describe them in detail.

The next organ is the small intestine, or, as it is sometimes called, the "ileum." In the human body the small intestines are much more elaborate. It is in this that the food, after its digestion, passes, and where, by absorption, the nutrient particles not already absorbed pass into the blood, and so on throughout the system.

You will notice, also, at *l*, some small radiating filaments. These are called the malpighian tubes. It is not certain what their office is, but it is thought that these are the urinary organs.



HONEY-BEE DISSECTED: AFTER WITZGALL.

At the end of the small intestine, *k*, you will notice an enlargement, *m*. This is what is called the colon. Although the appearance of the colon in the bee is different from that in the human body, yet its functions are very much the same; and if allowed to become dammed up by excreta (that is, by retention during winter) it is liable to cause disease in the bee, just the same as in the human body. Mr. Cowan, the author of the book mentioned at the outset, says:

From the colon, what remains of the undigested food is expelled by the anal opening. For this purpose strong muscles exist, by which the colon is compressed and the excreta ejected.

The quantity of the excreta voided, usually of a dark brown color, is regulated by the nature of the food; bad honey, an improper substitute for honey (such as glucose) producing a larger amount, while good honey and good syrup produce less, a larger proportion of it being digested and absorbed. It is, therefore, important that bees should have good food, as, in a healthy condition, workers never void their fæces in the hive, but on the wing. In the winter it is retained until voided on their first flight.

So you see, then, that bad food makes mischief, just the same as it does in the human body, and it is in this colon that the overplus of fæces is stored during winter.

HOW THE BEE "MAKES" HONEY.

After the nectar is gathered it is then transferred from the tongue to the œsophagus and thence to the honey-stomach, *g*. It

has been shown repeatedly by experiment that there are many more pollen grains in the nectar than in honey; hence the little stomach-mouth *h* comes into play in separating the grains from the honey. On arrival at the hive, the bee regurgitates—that is, expels the contents of the honey-sac into the cell; but during its stay in the honey-sac the nectar has undergone a change; that is, it has been converted, says Mr. Cowan, from the cane sugar of nectar into the grape sugar of honey, by the agency of a certain gland. This sustains the position held so persistently by Prof. Cook, and his view is doubtless correct.

But the bee may not regurgitate the honey, for it may pass directly into the chyle-stomach. We see, therefore, that, when a swarm issues, the bees, after filling their honey-sacs to their full capacity (a very small drop), can carry with them a supply of food to last them for several days; and even while on the wing, through that little stomach-mouth, *h*, they may take nourishment. So much for the alimentary canal, its office in digestion, and the honey-stomach.

THE NERVOUS SYSTEM.

Let us now turn our attention to the nervous system. By referring to the engraving you will see parallel and medial lines passing the entire length of the bee, and finally communicating with the brain *a*. Along at irregular intervals will be seen thickened masses called "ganglia." These are really little brains, and, as in our own bodies, preside over the involuntary muscles. The largest ganglion is the brain, at *a*, which is the seat of voluntary action and intelligence. One is surprised in reading through chapters 10 and 11 of Mr. Cowan's work, how thoroughly scientists have studied the structure of the nervous system as found in the bee. Even the tiny brain has been dissected, and its various functions pointed out—that is, what parts communicate with the antennæ, what part with the eyes, etc. I was greatly interested, in looking over the sizes of different brains found in different insects. I quote here a paragraph found on page 70 of Mr. Cowan's book:

> It is generally admitted, that the size of the brain is in proportion to the development of intelligence; and Dujardin, who made careful measurements, gives the following sizes: In the worker bee the brain is the $\frac{1}{174}$ of the body; in the ant, $\frac{1}{286}$; the ichneumon, $\frac{1}{400}$; the cockchafer, $\frac{1}{3290}$; the dytiscus, or water-beetle, $\frac{1}{4200}$.

In man the proportion is 1 to 40, I believe; but we all know that he is of the very highest order of intelligence. However, we are not very much surprised to learn that the bee has the largest brain of any of the insects, exceeding by far even that of the ant, whose intelligence we have admired over and over again.

THE RESPIRATORY SYSTEM.

It is also interesting to inquire how the bee breathes. By referring to the engraving given, we observe a couple of large air-sacs, called the "trachea," corresponding somewhat to the lungs. These are located on either side of the abdomen, as at *t*. These are divided and subdivided into smaller trachea, and these in turn ramify all through the entire body. Instead of fresh air being received in at the mouth, as with us, fresh supplies are admitted through 14 little mouths called "spiracles." Ten of these are located in the abdomen—five on each side—and are situated just about on the margin of the scales, between the dorsal and ventral segments. Four others are situated on the thorax, or waist, two on each side. You may, therefore, decapitate a bee and it will continue breathing as before. If you place a pencil dipped in ammonia near its body, the headless insect will struggle to get away; and if the pencil touches its feet, the ganglia already spoken of communicate the sensation to the other ganglia, and at once all the feet come to the rescue to push off the offending object, or, it may be, to take closer hold so the sting may do its work. Besides that, if bees are daubed with honey they will die very soon from strangulation, because these little mouths or spiracles are closed. A bee may swim around in a trough of water, and, though its head be entirely out, it will drown just the same, because these spiracles or breathing-mouths are submerged under water. On a hot day, if the entrance of a hive be closed the bees will soon begin to sweat; and, thus becoming daubed, the delicate spiracles are closed, and the bees die.

ROYAL JELLY, WHAT IT IS.

Cheshire insists that it is a *secretion* from one of the glands; but Prof. Cook has maintained that it is the product of the chyle-stomach; and Mr. Cowan proves conclusively that this is the right view.

This chyle is produced in what is called the chyle-stomach, shown at *l*, in the engraving; and worker larvæ are fed on this concentrated food for three days, after which they are weaned. "On the fourth day this food is changed and the larva is wean-

ed; for the first pap has a large quantity of honey added, but no undigested pollen, as Prof. Leuckhart had stated. The drone larvæ are also weaned, but in a different way; for, in addition to honey, a large quantity of *pollen* is added after the fourth day." And right here I can not do better than quote from Mr. Cowan:

> Microscopic examination showed that, in the queen and worker larvæ, there was no undigested pollen; whereas in the drone larvæ, after the fourth day, large numbers of pollen grains were found. In one milligram, no less than 15,000 pollen grains were counted, and these were from a number of different plants. . . . This work of Dr. Planta's, we think, conclusively proves that the food is not a secretion, and that the nurses have the power of altering its constituents as they may require for the different bees. . . . Royal jelly is, therefore, chyle food, and this is also most likely the food given to the queen-bee. Schoenfeld has also recently shown that drones are likewise dependent upon this food, given to them by workers, and that, if it is withheld, they die after three days, in the presence of abundance of honey. This, he thinks, accounts for the quiet way in which drones perish at the end of the season. It will now be easily understood, that, if weaning of the worker larvæ does not take place at the proper time, and that the first nourishing food is continued too long, it may be the cause of developing the ovaries, and so produce fertile workers, just as the more nourishing food continued during the whole of the larval existence in the case of a queen develops her ovaries, or even in the absence of a queen the feeding of workers on this rich food may tend to have the same effect. This, then, is the solution of royal jelly and brood food.

For a more exhaustive treatment of the whole subject, see Cowan's work, The Honey-Bee; Cook's Manual of the Apiary, or Cheshire's Bees and Bee-keeping, Vol. I.

ANGER OF BEES. I confess I do not like the term "anger," when applied to bees, and it almost makes me angry when I hear people speak of their being "mad," as if they were always in a towering rage, and delight in inflicting exquisite pain on everything and everybody coming near them. Bees are, on the contrary, the pleasantest, most sociable, genial and good-natured little fellows one meets in all animated creation, when one understands them. Why, we can tear their beautiful comb all to bits right before their very eyes, and without a particle of resentment; but with all the patience in the world they will at once set to work to repair it, and that, too, without a word of remonstrance. If you pinch them they will sting, and anybody who has energy enough to take care of himself would do as much, had he the weapon.

We as yet know very little of bees comparatively; and the more we learn, the easier we find it to be to get along without any clashing in regard to who shall be master. In fact, we take all their honey now, almost as fast as they gather it; and even if we are so thoughtless as to starve them to death, no word of complaint is made.

There are a few circumstances under which bees seem "cross;" and although we may not be able to account exactly for it, we can take precautions to avoid these unpleasant features, by a little care. A few years ago a very intelligent friend procured some Italians, an extractor, etc., and commenced bee culture. He soon learned to handle them, and succeeded finely; when it came time to extract, the whole business went on so easily that they were surprised at what had been said about experienced hands being needed to do the work. They had been in the habit of doing this work as I had directed, toward the middle of the day, while the great mass of the bees were in the fields; but in the midst of a heavy yield of clover honey, when the hives were full to overflowing, they were one day stopped by a heavy thunder-shower. This, of course, drove the bees home, and at the same time washed the honey out of the blossoms so completely that they had nothing to do but remain in the hives until more was secreted. Not so with their energetic and enthusiastic owner. As soon as the rain had ceased, the hives were again opened and an attempt made to take out the frames, as but a few hours before; but the bees that were all gentleness then, seemed now possessed of the very spirit of mischief and malice; and when all hands had been severely stung, they concluded that prudence was the better part of valor and stopped operations for the day.[19] While loads of honey were coming in all the while, and every bee rejoicing, none were disposed to be cross; but after the shower, all hands were standing around idle; and when a hive was opened, each was ready to take a grab from its neighbor, and the result was a free fight in a very short time.

I know of nothing in the world that will induce bees to sting with such wicked recklessness as to have them get to quarreling over combs or honey left exposed when they have nothing to do. From a little carelessness in this respect, and nothing else, I have seen a whole apiary so demoralized that people were stung when passing along the street several rods distant. During the middle of the day, when bees were

busily engaged on the flowers, during a good yield, I have frequently left filled combs standing on the top of a hive from noon until supper time without a bee touching them; but to do this after a hard rain, or at a time when little or no honey is to be gathered in the fields, might result in the ruin of several colonies, and you and your bees being voted a nuisance by the whole neighborhood

Almost every season we get more or less letters complaining that the bees have suddenly become so cross as to be almost unmanageable, and these letters come along in July, after the clover and linden have begun to slack up. The bees are not so very unlike mankind after all, and all you have to do is to avoid opening the hives for a few days, until they get used to the sudden disappointment of having the avenues through which they were getting wealth so rapidly, cut off. After a week or ten days they will be almost as gentle as in the times when they gathered half a gallon of honey daily, if you are only careful about leaving hives open too long, or leaving any bits of honey or comb about.

A young man who was once in my employ, and who laughed about being afraid of bees, commenced work in the apiary with such an earnest good will that I had high aspirations for him. One beautiful morning he was tacking rabbets into the hives in front of the door to the honey-house, whistling away as happy as the bees that were humming so merrily about his head. Pretty soon I saw some honey and bits of combs that had dropped from one of the hives, scattered about on the ground. I told him he had better stop and clean it up, or he would certainly get stung: as the bees seemed very peaceable while licking it up, he thought he would let them have it, in spite of my warning. After they had taken all the honey, they began buzzing about for more; and, not finding any, in a very ungenerous way commenced stinging him for his kindness. His lesson was a more severe one than I had expected, for they not only drove him from the apiary that morning, but I fear for all time to come; for although years have passed, he has never since wanted any thing more to do with bees. I regret that he did not, at the time, also learn the folly of insisting on having his own way.

I can not tell you, at present, why bees sting so coolly and vindictively just after having had a taste of stolen sweets, yet nearly all the experience I have had of trouble with stinging has been from this very cause. Bees from colonies that have a habit of robbing will buzz about one's ears and eyes for hours,[20] seeming to delight in making one nervous and fidgety, if they succeed in so doing, and they not only threaten, but oftentimes inflict, the most painful stings, and then buzz about in an infuriated way, as if frantic because unable to sting you a dozen times more after their sting is lost. The colonies that furnish this class of bees are generally hybrid, or perhaps black bees having just a trace of Italian blood. These bees seem to have a perfect passion for following you about, and buzzing before your nose from one side to the other (until you get cross-eyed in trying to follow their erratic oscillations), in a way that is most especially provoking. One such colony annoyed us so much while extracting that we killed the queen, although she was very prolific, and substituted a full-blood Italian. Although it is seldom a pure Italian follows one about in the manner mentioned, yet an occasional colony may contain bees that do it; at least we have found such, where the workers were all three-banded. That it is possible to have an apiary without any such disagreeable bees, we have several times demonstrated; but oftentimes you will have to discard some of your very best honey-gatherers, to be entirely rid of them.

With a little practice the apiarist will tell as soon as he comes near the apiary whether any angry bees are about, by the high key-note they utter when on the wing. It is well known, that with meal feeding we have perfect tranquillity although bees from every hive in the apiary may be working on a square yard of meal. Now, should we substitute honey for the meal, we should have a perfect "row;" for a taste of honey found in the open air during a dearth of pasturage, or at a time when your bees have learned to get it by stealing instead of honest industry, seems to have the effect of setting every bee crazy. In some experiments to determine how and why this result came about, we had considerable experience with angry bees. After they had been robbing, and had become tranquil, we tried them with dry sugar; the quarrelsome bees fought about it for a short time, but soon resumed their regular business of hanging about the well-filled hives, trying to creep into every crack and crevice, and making themselves generally disagreeable all round. If a hive was to be opened, they were into it almost before the cover was raised, and then resulted a pitched battle between them and the inmates; the

operator was sure to be stung by one or both parties, and, pretty soon, some of the good people indoors would be asking what in the world made the bees so awfully cross, saying that they even came indoors and tried to sting. Now, why could they not work peaceably on the sugar as they do on the meal, or the clover-blossoms in June? We dampened the sugar with a sprinkler, and the bees that were at work on it soon started for home with a load; then began the high key-note of robbing, faint at first, then louder and louder, until I began to be almost frightened at the mischief that might ensue. When the dampness was all licked up, they soon subsided into their usual condition. The effect of feeding honey in the open air is very much worse than from feeding any kind of syrup, and syrup from white sugar incites robbing in a much greater degree than that from brown sugar; the latter is so little relished by them that they use it only when little else is to be found. It is by the use of damp brown sugar that we get rid of the greater part of what are usually termed angry bees, or bees that prefer to prowl round, robbing and stinging, rather than gather honey "all the day," as the greater part of the population of the apiary does. The sugar should be located *several rods away*, and should be well protected from the rain, but in such a way as to allow the bees to have free access. When no flowers are in bloom, they will work on it in great numbers; but when honey is to be found, you will see none but the prowling robbers round it. These, you will very soon notice, are mostly common bees and those having a very little Italian blood. We have seen Italians storing honey in boxes, while the common bees did nothing but work in the sugar-barrels. Where you work without a veil, it is very convenient to have these annoying bees out of the way, and, even if they belong to our neighbors, we prefer to furnish them with all the cheap sugar they can lick up.

The remarks that have been made are particularly for large apiaries; where one has only a single hive and no neighbors who keep bees, the case is something like Robinson Crusoe on the island; no chance for stealing, and consequently nothing to be cross about. Bees are seldom cross or angry, unless through some fault or carelessness of your own. See ROBBING; also STINGS.

ANTS. Although I have given the matter considerable attention, I can not find that ants are guilty of any thing that should warrant, here in the North, the apiarist in waging any great warfare against them. Some years ago a visitor frightened me by saying that the ants about my apiary would steal every drop of honey as fast as the bees could gather it. Accordingly, I prepared myself with a tea-kettle of boiling water, and not only killed the ants but some grapevines growing near. Afterward there came a spring when the bees, all but about eleven colonies, dwindled away and died, and the hives filled with honey, scattered about the apiary unprotected, seemed to be as fair a chance for the ants that had not "dwindled" a particle, as they could well ask for. I watched to see how fast they would carry away the honey, but, to my astonishment, they seemed to care more for the hives that contained bees than for those containing only honey. I soon determined that it was the warmth from the cluster that especially attracted them; and as the hives were directly on the ground, the ants soon moved into several that contained only a small cluster and for awhile both used one common entrance. As the bees increased, they began to show a decided aversion to having two families in the same house, although the ants were evidently inclined to be peaceable enough until the bees tried to "push" matters, when they turned about and showed themselves fully able to hold possession. The bees seemed to be studying over the matter for a while, and finally I found them one day taking the ants, one by one, and carrying them high up in the air, and letting them drop at such a distance from their home, that they would surely never be able to walk back again. The bees, as fast as they became good strong colonies, drove the ants out; and our experience ever since has been, that a *good* colony of bees is never in any danger of being troubled in the least by ants. One weak colony, after battling awhile with a strong nest of the ants, swarmed out; but they might have done this any way, so we do not lay much blame to the ants.

But ants do prove to be very annoying in those apiaries where there is any attempt to keep the grass down with a lawn-mower. The little hillocks that they make all over the yard disfigure it to some extent, as well as forming more or less obstruction to the scythe and lawn-mower. While, as I have already said, ants do little if any damage to hives in the North, yet as it is so easy to eradicate them it may be well to consider methods for their extermination.

HOW TO DESTROY ANTS' NESTS.

With a crowbar or a sharp stick and a mallet make a hole an inch or so in diameter, and about a foot deep, down through the center of the nest. Around this hole make two or three other similar ones, or more if the nest is a large one. Go to the drugstore and get about a dime's worth of bisulphide of carbon. Be careful with the stuff, for it is very explosive, and the fumes of it should not be allowed to collect in the room where there is a gasoline flame or any stove or lamp burning. From this bottle pour about a tablespoonful of the liquid in each hole; then immediately stop each up with a plug of earth, for it is desired to have the fumes of the bisulphide penetrate all the galleries of the nest, thus destroying ants, larvæ, and eggs. In a day or so it will be found that every thing formerly animate in and about that nest is dead—*very* dead.

But if the nests are not very large, one can secure almost as good results by using coal oil or gasoline in place of the bisulphide. But in using these, about twice or three times the quantity should be used in each hole. Very recently I have been trying both gasoline and coal oil, and have found each effective in destroying the nest. Of the two, the coal oil (or kerosene as some call it) seems to be preferable. In using bisulphide of carbon, gasoline, or coal oil, be careful about spilling or pouring any of it on the top of the nest, as that will kill the grass, leaving a brown spot right where it should be green. The bisulphide is more apt to kill the grass than the gasoline or coal oil, as it is much more powerful. All things considered I would recommend the use of kerosene.

The best time to destroy ants' nests is to go early in the spring, before the ants have had an opportunity to make much of a hillock; then there will be less liability of killing the grass, or, rather, a better opportunity for the grass to recover from its "dose" during the early spring rains.

ANTS IN THE SOUTH.

These insects are much more troublesome in the Southern States, and all warm climates, in fact, than in the North. Sometimes they are so large and powerful that they even set about to destroy the colony. I would first find the nest, and proceed to destroy by the use of kerosene or gasoline. If these do not prove to be powerful enough, use bisulphide of carbon, making three or four holes to the square foot of nest; but in the case of the bisulphide, one must be careful to have each hole stopped up tight with plugs of earth, otherwise the gas will escape, and the effect of the liquid will be largely lost.

But there is a species of ants in warm climates that have nests in trees that are inaccessible. Other ants are so small, and come such long distances, that it is almost impossible to find their nest. In such cases it has been recommended to place within their reach some syrup or honey mixed with arsenic, Paris green, London purple, or strychnine. It is unnecessary to say that all vessels containing such poisonous mixtures should be placed in a box covered with screen just fine enough to keep out bees, and yet coarse enough to admit the ants. They will work on these poisonous mixtures, and carry them home to their young, with the result that both mature insects as well as larvæ will be destroyed, no matter where the nest may be. Mr. E. H. Schæffle, of Murphys, Cal., who recommends this method of feeding ants with poisoned sweets, says the plan is very effective, for their visitations will soon cease. But he stipulates that the box containing the poisonous sweet should be placed in the trail of the ants.

When it does not seem practicable to destroy the pests they may be kept away from the hive temporarily by pouring a little narrow trail of coal oil clear around the hive or hives. The ants will come up to the oily line, and there stop.

Some of our Southern friends have found these pests to be so destructive that it has been necessary to put the hives on legs and then stand the legs in vessels of water or coal oil. But if such destructive enemies as this do make a visit I would make an effort to find their nest, and then give them a dose of bisulphide of carbon, for that will "settle 'em" for all time.

If there is a tremendous "swarm" of wood ants in a big tree, with a syringe or squirt-gun inject about a pint of bisulphide of carbon in the hollow of the tree. Stop up the openings, and I'll guarantee that they will never trouble more.

APIARIST. One who keeps bees, or a bee-keeper; and the plot of ground, including hives, bees, etc., is called an

APIARY. As you can not well aspire to be the former until you are possessed of the latter, we will proceed to start an apiary.

LOCATION.

There is scarcely a spot on the surface of the earth where mankind finds sustenance, that will not, to some extent, support bees,

A MODEL APIARY IN CALIFORNIA, OWNED BY J. F. M'INTYRE, VENTURA.

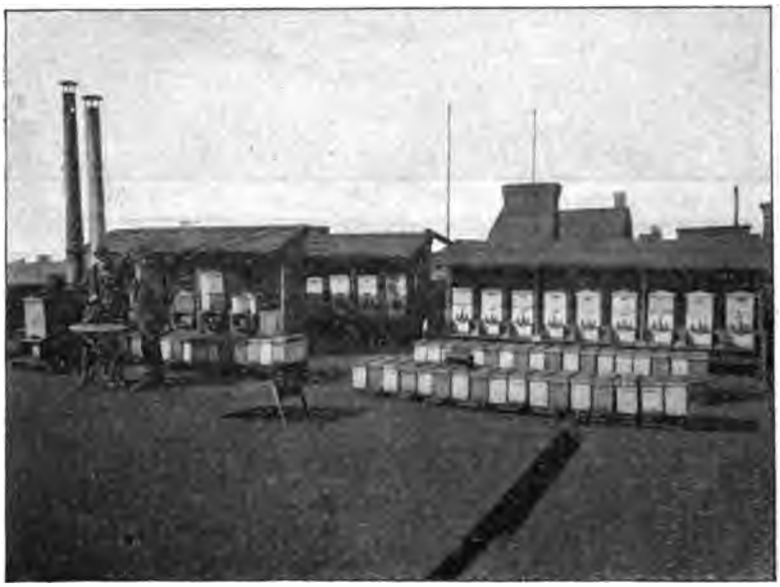
ANOTHER MODEL APIARY OF 500 COLONIES IN CALIFORNIA, OWNED BY M. H. MENDLESON, NEAR PIRU CITY.

although they may do much better in some localities than in others. A few years ago it was thought that only localities especially favored would give large honey-crops; but since the introduction of the Italians, and the new methods of management, we are each year astonished to hear of great yields here and there, and from almost every quarter of the globe. It will certainly pay to try a colony or two of bees, no matter where you may be located.

Bees are kept with much profit, even in the heart of some of our largest cities. In this case, the apiary is usually located on the roof of the building, that the bees may be less likely to frighten nervous people and those unacquainted with their habits. Such an apiary should be established like those on the ground in all essential points.

of *old* trees seventy-five or a hundred feet from the road or highway. Usually the rear end of a village lot just back of the house will answer very nicely. If the apiary *must* be located close to the highway, then a high board fence should be placed between the bees and the street. A hedge of osage orange, or evergreens; a trellis of some sort of vine; trees, shrubbery, or any thing that will cause the bees to raise their flight to a height of ten or twelve feet above the traffic of the street may be used. In any case, the bees should never be allowed to go direct from their hives on a line that would encounter vehicles or pedestrians; otherwise their owner may have a lawsuit on his hands for alleged damages from bee-stings.

If the orchard where the bees are to be located is made up of *old* trees, then there



THE ROOF APIARY OF C. H. W. WEBER, CINCINNATI, OHIO.

It is not always possible to select just the location for an apiary that we might like, and we are therefore compelled to take what we can get; but where conditions permit I would select the rear of a village lot; or, if I were located on a farm, back of the house in an orchard. The ground should be rolled and smoothed down so that a lawn-mower can run over every portion of it, as the grass should be kept down around the hives. And then, too, a smooth plot of ground renders the use of a wheelbarrow or hand-cart for handling loads much more pleasant and convenient. A spot that I would consider ideal would be an orchard

can be from four to five hives grouped under each tree. If, on the other hand, it consists of young ones, then not more than one or two hives should be placed at a tree, and in that case always on the north side, to be in the shade. The hives should be so located that they will get the morning sun up to eight or nine o'clock, and the afternoon sun from three or four o'clock on. Too much shade is detrimental, and too much hot sun pouring directly on the hives is equally bad. If the apiarist uses a little skill in the arranging of his hives, and in trimming the lower branches of his trees, the direct rays of old Sol may be cut off during the heat cf

A PART OF THE APIARY OF THE AUTHORS OF THIS WORK.

the day, and be allowed to shed their benign influence during the early and later portion of the day automatically.

Well, suppose one does not have trees of any sort in his yard—what shall he do? One of four courses lies open: First, to use double-walled hives; second, single-walled hives with shade-boards; third, single-walled hives having on the south side of them some sort of vine that can be reared up within a year or two. A grapevine trellis, say 8 feet high and 10 or 12 feet long, running from east to west, well covered with a vine, can be made to protect anywhere from five to ten hives. On this trellis, grapevines or any other quick-growing vine may be reared, providing shade during the heat of the day. The fourth and last plan is to use overhead trellis, making use of straw, dried grass, or brush for a covering such as is used extensively in Arizona. See cuts here shown. These trellises are about 7 ft. high, and run from east to west, so that the sun, nearly overhead as it is in Arizona, never strikes the hives from morning till night. These trellised shades, if there are no trees, are indispensable in hot localities. They thoroughly protect the bees, prevent combs melting down, and render the work of the apiarist pleasant. The expense of these trellises is small, for they can be made of material found in the localities. To cheapen the cost, wire may be used, drawn taut, back and forth over the top of the framework; the dried grass or weeds are laid on top of them; more wire is stretched across to hold them in place.

But some bee-keepers prefer to use shade-boards. These consist of large covers cleated on the ends, and made of two or three boards of the cheapest lumber that can be had. They should be large enough to project a foot over the front and rear, and an equal distance on each side. They are then held in place by a stone weighing 15 or 20 lbs.

But whenever one manipulates these hives he is required to lift a heavy stone and remove an awkward shade-board before he can do any work with the bees.

Taking it all in all, I would make an extra effort to procure some sort of natural shade that will give comfort to the bees and to the apiarist as well; and if one does not care to wait for trees to grow he can have vines reared up inside of a year that will give him practically all the shade he requires.

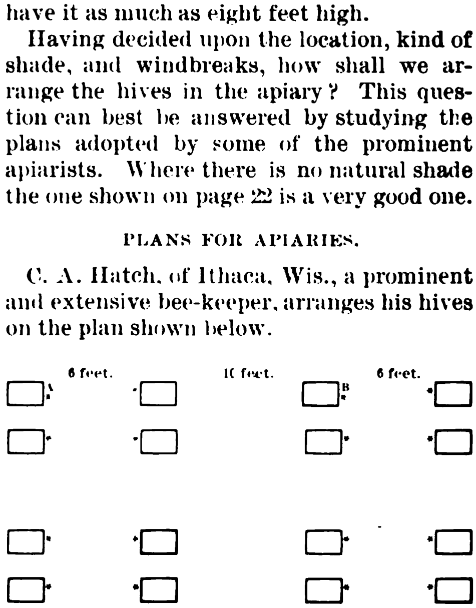
WINDBREAKS.

The most perfect windbreak is an inclosure of woods on three sides, with an opening to the south. This, however, is not available to all. An apiary so situated that there is a clump of woods on one side and buildings on the other two sides, leaving only a southern aspect, is well sheltered from the prevailing winds. In the absence of any natural or accidental protection whatever, it is quite essential that some sort of windbreak be provided. If I desired to put up something permanent, and something which would not rot out or require repairs, I would outskirt the apiary with rows of hardy-growing evergreens, such as are seen in our own apiary in the following pages. These, for the first few years, would afford but a scanty protection; but in 10 years' time they answer their purpose admirably. In 1879, we inclosed our apiary with evergreens. They have proved to be very thrifty, and now (1902) are quite good-sized trees, averaging 35 feet in height. In a few years more their branches will be tightly interwoven; and a more solid and lasting phalanx could hardly be desired as a windbreak. Only a few of my readers will feel disposed to go to this expense when the benefits of such outlay are so far ahead, and they are not sure that ten years hence they will be following bee-keeping as a pursuit. I would recommend to such a tight board fence. It should surround the plat, at least on the north and west sides, to keep off cold winds; and if it can be made strong enough to stand the prevailing winds it will be all the better to have it as much as eight feet high.

Having decided upon the location, kind of shade, and windbreaks, how shall we arrange the hives in the apiary? This question can best be answered by studying the plans adopted by some of the prominent apiarists. Where there is no natural shade the one shown on page 22 is a very good one.

PLANS FOR APIARIES.

C. A. Hatch, of Ithaca, Wis., a prominent and extensive bee-keeper, arranges his hives on the plan shown below.

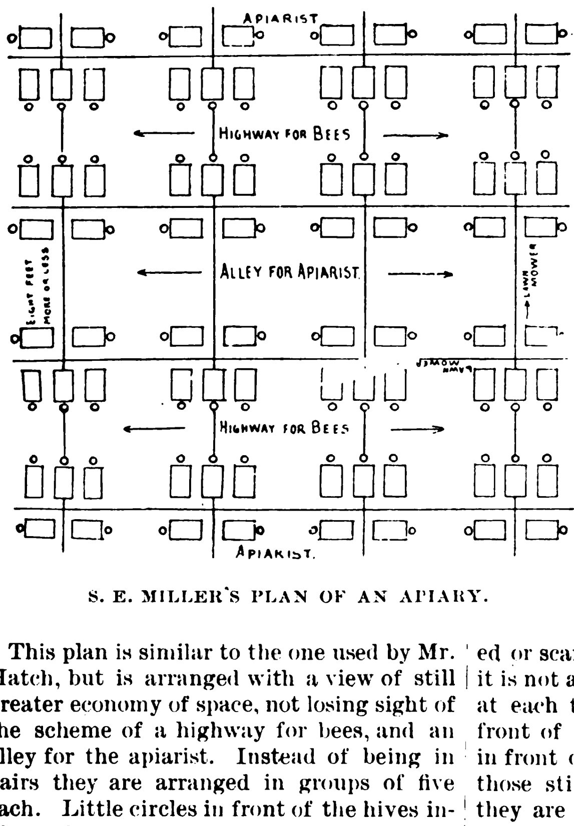


A PART OF AN APIARY ARRANGED ON THE STRAIGHT-ROW PLAN.

APIARY OF J. WEBSTER JOHNSON, TEMPE, ARIZONA, SHOWING THE METHOD OF SECURING SHADE BY MEANS OF A TRELLIS.

SIDE AND END VIEW OF THE SAME APIARY.

The stars in the preceding diagram indicate the entrances. There are two lanes, or alleyways, one six feet wide, for the bees, and one ten feet wide, for the apiarist, and his horse and wagon, etc. You will notice that the hives are arranged in pairs, in such a way that they face each other with entrances six feet apart. In the next alley their *backs* are toward each other. An apiary on this plan can be made as large as desired.



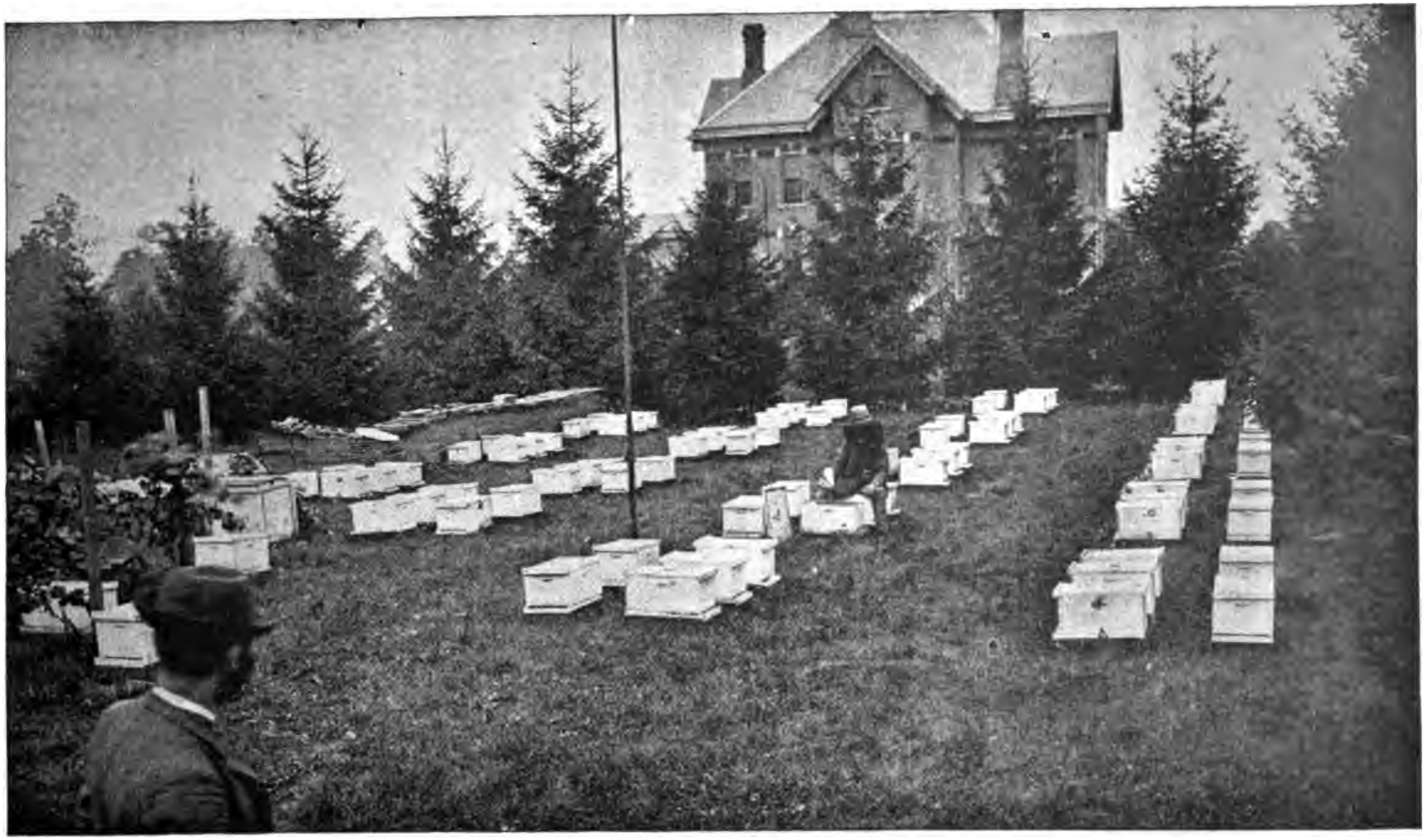
S. E. MILLER'S PLAN OF AN APIARY.

This plan is similar to the one used by Mr. Hatch, but is arranged with a view of still greater economy of space, not losing sight of the scheme of a highway for bees, and an alley for the apiarist. Instead of being in pairs they are arranged in groups of five each. Little circles in front of the hives indicate the entrances. The hives should be 18 inches apart to give room for a lawn-mower. It would hardly do to put them closer than 12 inches, for long timothy grass will grow up between, and then it is difficult to clean it out; and if not cut out it is in the way of putting on the supers. The groups can be from 10 to 20 feet apart; but if put exactly 16 feet apart, and the hives in the group 18 inches apart, an apiary of 80 colonies can be accommodated on a plot 75 feet square, or in the back yard of an ordinary town lot. One advantage of this grouping plan is, that the apiarist can sit on one hive while he is working on another; and his tools, such as smoker, honey-knives, bee-brushes, etc., are right at hand for the whole five hives. Where there is only one hive on a stand, the tools have to be carried to each hive.

The illustration on next page gives a view of a portion of our apiary just as it has been brought back from the outyard at the basswoods, and placed in one corner of our home yard, said corner being sheltered on the west and north sides by the evergreens that have, since that picture was taken, grown to be large, solid, handsome trees, with limbs so closely intertwined that the force of the wind is almost entirely broken. It will be seen that the apiarist sits on one hive of a group while operating on another. The general scheme is as pretty in practice as it is in theory; and it is an actual fact that one can crowd more colonies on a given area (and yet leave more room to run wagons or carts among the hives), than with any other plan with which we are acquainted.[315]

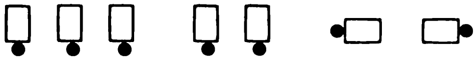
This particular apiary lacks one important element — shade-trees — except such shade as the evergreens give in the afternoon to those colonies nearest the west side.

The Miller plan is specially well adapted to a location in a grove; but as trees often vary in size the foliage is sometimes lopsided or scant on some of the trees, and hence it is not always practicable to put five hives at each tree. It is our practice to place in front of the smallest trees only one hive; in front of those a trifle larger, two hives; those still larger, three hives; and when they are of fair size, five, as in the Miller plan. Arranging the hives thus, gives each group of one, two, three, or five, as the case may be, an individuality of its own, thus affording the bees a better chance to distinguish their own group; but in every case the precaution must be observed of placing the hives on the *north* side of the tree. Where there are two and three in a group, one can have the entrances pointing toward the south; or if there are only two in a group he can have one hive with its entrance pointing toward the west, and the other hive toward the east. In any case I would avoid having hives face the north. The following diagram shows how the hives on the three and two plan may be arranged, consid-



A CORNER OF THE ROOT CO.'S APIARY ARRANGED ON THE S. E. MILLER PLAN.

ering, of course, that the tree is just south of the hive, and one, two, three, or four feet from it.



We have tested the plan for apiaries arranged, one alleyway for bee-flight and one for the apiarist; and so have a good many competent bee-men. The bees seem to recognize this narrow alleyway as their own allotted highway; and when they are working heavily, said highways are literally full of bees, while the broad ones are more free. In some apiaries in California I found double rows of hives, with a double alleyway between them, instead of being parallel, diverge from a common center, like the spokes of a wheel. Of course, in this case the honey-house or work-shop should be at the hub, or center, of the system.

KEEPING GRASS DOWN AROUND THE HIVES.

Having decided on the location and plan of the apiary, the next question that would naturally arise is, Shall the grass be allowed to grow and be kept down to an even height with a lawn-mower? or shall the sod be cut off entirely, and the hives be placed on a smooth plot of clay leveled off like à brick-yard? In favor of this last arrangement it may be said that queens can be easily found, and that, when the sod is once removed, all that is necessary is to go around the hives with a hoe or scraping-knife to shave off the weeds as fast as they come. If they are kept down thus, and the plot is sprinkled with a thin layer of sawdust raked over evenly, we have an almost ideal spot; such a yard is shown in the illustration of H. R. Boardman's apiary, herewith reproduced. While ground floors of this kind are nice and pretty to look at, it means a great deal of labor and expense, because there is almost constant warfare against the weeds. They will crowd their heads up through the sawdust; and at the piesent low prices at which honey sells, it may be doubted whether one is warranted in going to such expense and trouble. The great majority of bee-keepers, however, after having leveled the plot, leaving the sod, consider it sufficienf to keep the grass down with a lawn-mower. If it is mown once or twice a week, the yard not only looks pretty but practically there is no inconvenience resulting from the short grass; and to my eye, at least, a lawn apiary is much prettier, and about as convenient in every way as one with a brickyard bottom.

KEEPING DOWN THE GRASS AT THE ENTRANCES OF THE HIVES.

It is not practicable to run a lawn-mower any closer than about two inches to a hive; and it is therefore our practice to sprinkle salt in front of the entrances and around the hives. This kills all vegetation up to a point where the lawn-mower can reach it.

But a good many apiarists do not even have the time to use a lawn-mower. As it would be a great task to keep the grass down in front of the hives where it would obstruct bees heavily laden from the fields, it is a very common practice to use a board a little longer than the entrance, and a foot or 18 inches wide. This board should be cleated on the back, and should be attached to the hive so that the bees may have an easy runway clear up to the entiance. These boards may be planed and painted; but ordinarily I would recommend rough unplaned stuff—the cheaper the better. This gives the bees a good foothold, and at the same time saves some expense.

SHEEP FOR KEEPING DOWN GRASS IN THE APIARY.

One of our neighbors lets loose a flock of sheep in his apiary occasionally. It is well known that our woolly friends can gnaw the grass closer than any other stock. If a few of them be turned into an apiary for a day or two they will cut down all the vegetation close to the hives, not leaving even a sprig of any sort. One would naturally suppose that the bees would sting the animals, with the possible result that a hive or two would be overturned; but in actual practice no trouble results. Once in a great while a sheep is stung; but instead of running and bellowing like a calf, or kicking and rearing like a horse, these animals quietly walk off to a bush and plunge their heads into it, and keep them there until all is quiet. A bee can not possibly hurt them except around the eyes and nose. But it is so seldom that they attack them that one can not consider it cruelty to animals to use them as lawn-mowers. If one does not care to have them stung at all he can turn them into the apiary just at night, and before daylight drive them out again. But I have been in a yard where two or three sheep were allowed to graze all the season through, and in all that time they were not stung more than once or twice, and yet the grass was kept down *automatically over every square foot of the apiary.*

One would suppose the droppings might be somewhat offensive; but my neighbor as-ures me that this is not the case, as the

APIARY OF H. R. BOARDMAN, EAST TOWNSEND, OHIO, SHOWING THE FINE SHADE AFFORDED BY AN ORCHARD OF APPLE [illegible]

manure very soon sun dries, and it is of such a nature that it makes no trouble in the first place.

I am not sure but it would pay many apiarists to buy one or two lambs and let them grow up among the bees. At the end of the season they would have a supply of mutton and wool as well as honey.

THE HOUSE-APIARY.

As a general thing, an outdoor apiary is cheaper and more satisfactory than one in a building. For the house-apiary, the capital to put up the building must be furnished at the outset; and one that will take 50 colonies will cost much more than the same number of hives intended for outdoor use. But there are conditions under which the house-apiary may be and is used to advantage—in fact, affording the only method of keeping bees at all. Where land is valuable, such as in or near the city, or in localities occasionally visited by the depredations of thieves, where bees, honey, and every thing so far as possible, must be kept under lock and key, it is a necessity. A small building, also, to accommodate 35 or 40 colonies, even when these conditions do not exist, may often be used very advantageously in connection with the regular apiary outdoors. When robbers are bad, or when the day is rainy, the work can continue right on, because the apiarist can leave the outdoor bees and resume operations inside, free from robbers in the one case, or protected from inclement weather in the other.

Up till very recently, house-apiaries have not been regarded with very much favor among practical bee-keepers, principally on account of faulty construction, and because bee escapes, when house-apiaries began to come into use in certain quarters, were not known; but since the advent of the latter labor-saving device, the troubles arising from bees leaving the hives, and crawling over the floor to die, or to be trampled on if not already dead, at the first visit of the apiarist, are done away with. These and other inconveniences have been almost wholly removed; and perhaps the only reason why the house-apiary is not more generally used is because of the expense, or first cost.

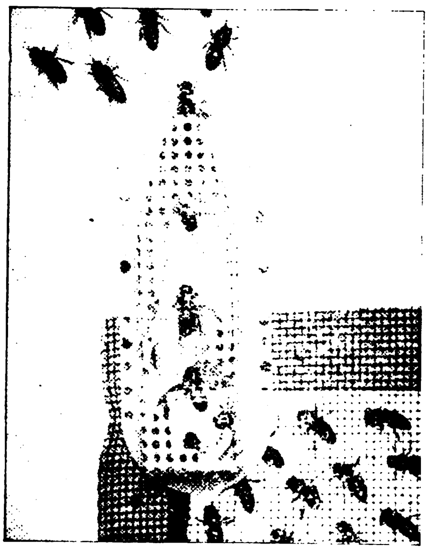
HOW TO CONSTRUCT A HOUSE-APIARY.

The building may be oblong, square, octagonal, or round. The round or octagonal form will, perhaps, save steps during the operation of extracting; because, if the building is only 12 or 14 feet in diameter, the extractor may be put in the center of the room, and every hive will be equally distant, or practically so, and the combs may be transferred from hive to extractor, and *vice versa*, without taking more than one step; whereas, if the building is oblong some hives will be further from the seat of operations. The house-apiary building we are using is octagonal; but we found it a very expensive thing to make, and we were greatly annoyed by a leaky roof; and the only way to make it tight, with its many angles, was to cover it with tin. We would, therefore, construct a plain square building, say 12 feet across. For a roof we would adopt the plain gable, covering it with shingles. On account of wintering, the building ought to be double-walled, and it would be better if sawdust or some sort of packing material were poured in between the two walls. Our own building is lined on the inside with tarred paper, and re-covered with manilla paper; but we are not sure that we would recommend it for any one else, because holes are constantly being punched through it. A better way would be to line it with wood—some cheap flooring would be good enough. If the joints are made tight, so that the packing-material will not leak, plain No. 2 barn-boards would answer. Through the roof, and extending through the center of the ceiling, we would have a ventilator-shaft, made of wood, about a foot square, and so arranged that it can be closed at will. During summer weather the smoker should be set directly beneath the shaft, and the ventilator opened for the escape of smoke. It should always be closed before leaving the building, because it is desirable to have the room perfectly dark, except at the small openings, where bee-escapes are to be placed, as we shall soon explain.

As to a door and windows, there should be only one window, and that opposite the door, so as to allow a draft to pass directly through, because the building at best becomes very sultry in hot summer weather. An ordinary tight-fitting door should be used, hinged in the usual way. To the outside of the door-frame there should be a wire-cloth screen-door. At the top of the door the wire cloth should extend up as shown in the cut; that is to say, it should be nailed on the outside, and should extend four or five inches beyond the bottom inside edge of the frame, leaving a bee space

between the frame and cloth. This is to allow the bees that collect in the room during the time of working, as for instance during extracting, to escape in accordance with the natural instincts that prompt them

to crawl upward. The window should have wire cloth nailed on the outside in like manner, the same extending above the window-casing as in the figure.



PORTER HONEY-HOUSE BEE-ESCAPE.

A much better arrangement, and the expense is but slight, is ordinary screen windows. At two of the upper corners attach a Porter honey-house bee-escape, as shown in the accompanying cut. This will be more reliable, as the robbers can not by any possibility return through the Porter, while they may learn the way back through the projecting screen.

At several points, close on a line with the floor, should be one-inch holes, on the outside of which should be more Porter honey-house bee-escapes. The purpose of the opening in these escapes is, to let the bees that happen to be inside after working crawl out toward the light; and, once outside, they will enter their own hives, with the possible exception of a few young ones, and they will be accepted at any of the entrances.

A few years ago it was not deemed necessary to have any thing but end-boards to hold up the frames. These boards resting on the floor or shelf were secured against the side of the building. It remained then to close up the open side with a tight-fitting division-board, and the top with a quilt. But in practice this was found to be very objectionable; and those who manage house-apiaries now prefer to use ordinary outdoor hives instead, primarily because the bees can be more easily confined to the hives; and, secondarily, because the indoor and outdoor hives are one and the same, and interchangeable.

The entrances of the hives are so arranged that they will communicate with an opening through the side of the building; and then the ordinary cover should be used to confine the bees strictly within the hives. In lieu of a cover a thin ⅜ board, or something of that sort, may answer just as well; but so far as possible we would adapt every thing in the house apiary so that every thing outdoors may be moved inside, and *vice versa*, whenever requirements make it necessary. The dimensions of the house-apiary inside should be just large enough to take a row of your hives without wasting space.

For entrances to the hives from the outside there should be a two-inch round hole, lined with a tin tube that has first been painted, and then dusted on the inside with some fine sand while the paint is fresh, so as to make it rough enough for the bees to cling to the outside surface. These tin tubes should be inserted at the time of the construction of the building, and before the packing-material has been poured in, and should be high enough for the bottom of the tube to come flush with the top of the bottom-board. To connect this tin tube to the hive entrance is not difficult.

As the entrance through the house-apiary is 2 inches in diameter, it will be necessary to have a raised rim about 2 inches deep, the same width and length as the regular hive you are using. The side of the rim next to the building should be cut away for the 2-inch entrance, or else the whole side be left off entirely. This rim should be nailed down in position.

This rim will, of course, take the place of the regular bottom-board. It is not absolutely necessary to make it two inches deep; it can be only one inch deep if preferred. The entrance then, instead of being at the ends of the frames, will be at the sides, or make a side entrance.

On account of convenience in handling frames, it is necessary to have the hive's side against the building.

Now, to further economize the space of the building, there should be another tier of hives about 4 feet above the floor; and these should be supported by shelving that reaches clear around the room. The same arrangement with regard to the entrances may be employed as described for the bottom tier.

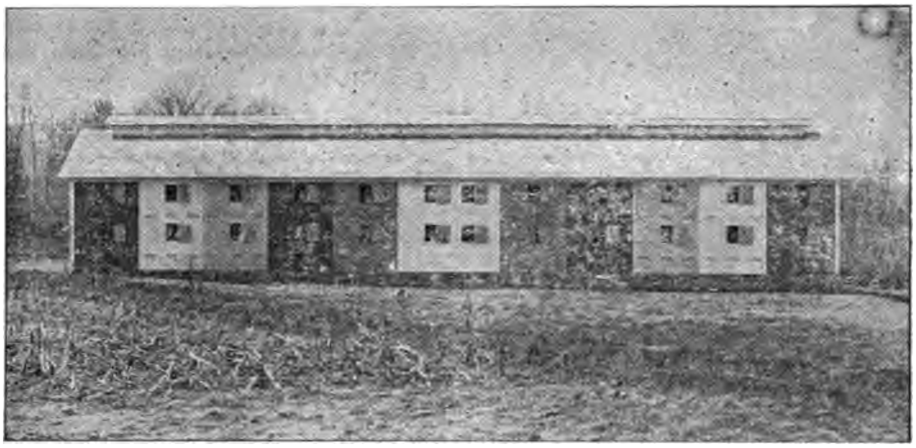
Now let me insist again. Do not delude yourself with the idea that you can build hives cheaper, and have them a part of the building. You are making a great mistake if you do. The ordinary outdoor hives are in every way much more handy. And another thing, do not be satisfied to put just a mere quilt on top of the frames. It is absolutely necessary that the bees be confined strictly to their own hives, otherwise they will be crawling from one hive to another, killing queens occasionally, getting on the floor, getting mashed, to say nothing of the inconvenience to the apiarist when he desires to do any work inside.

THE F. A. SALISBURY HOUSE-APIARY.

Perhaps the most extensive user of house-apiaries in later years is Mr. F. A. Salisbury, of Syracuse, N. Y., who lives in the suburbs of that city, where land is expensive. In order to get as many colonies as possible on the back end of a city lot, he constructed a house-apiary after his own ideas; and as this seems to be, perhaps, the most practicable building ever devised, of the kind, I place before you an article written by him for our journal, *Gleanings in Bee Culture*, Sept. 1, 1895. At this writing, April, 1899, he is still using the building, with little or no modification. This is what he has to say about his house-apiary:

In the fall of 1893 I built my first house-apiary, and liked it so well during the season of 1894 that I built another out about three miles, near Split Rock. The first view shows how the last one looks from the outside. The whole is on a stone foundation, with five windows in it for ventilation, 6x18 inches. On top of the wall is imbedded in the mortar a 2x10 inch; on top of this are placed the joists, 2x10, two feet apart. Beginning at each end, the second one is to be 28 in. from the end to center of stud. The rest to be 24 inches from center to center.

Begin the laying of the floor from each side, laying about two boards; then put up the studs; on top of them the plate, and then the rafters. Studs are placed over the joists, and rafters over the studs. The plate is made of two 2x4-inch studding. Use cove ceiling for the siding. It is painted in five colors. Beginning at each end, each color takes six feet in width and runs from the cornice to the sill. First at each end is red; then white; then blue; then yellow; then green.[317]



HOUSE-APIARY OF F. A. SALISBURY, SYRACUSE, N. Y.

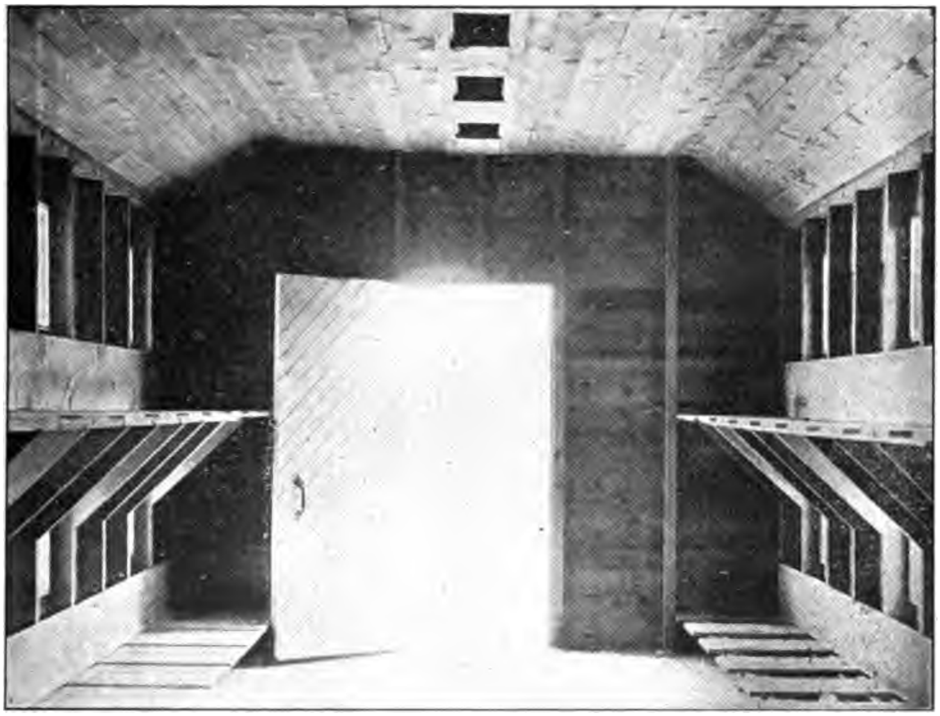
In the center there is a room 9 feet 4 inches wide, and 12 feet long, the outside of which is painted white. In the center of each color is a window without glass, but with doors 14×20 inches, that can be fastened. The hinges used are blind-hinges, and the catches are blind-catches. Along the ridge there is an opening running nearly the whole length of the building, 12 in. wide. Over this is built a roof. When shingled and sided up, the cupola has an opening on each side at the top of 3 in., running the whole length. In each end of the building there is a door. The entrances are cut through the siding ½×8 in. and an alighting-board 2×12 in. is nailed just under the opening, even with it.

The second view is an inside one, looking from the center toward one end. On each side you will notice there are two shelves, the bottom one being 8 in. from the floor, and the upper one 53. Doors are placed 15

in. from the shelves. On the shelves the hives are placed 2 feet apart.

The bottom of the hives or shelves proper are so made that the center of each hive is over a space that is open (see the shelf at the right on the bottom). In this space can be placed a board, making a tight bottom; or during the summer months the space can be filled with a frame covered with wire cloth. By using the wire cloth at the bottom the bees are much more comfortable in hot weather, and I think it has a tendency to prevent swarming. During the season of 1894 we had only 11 colonies swarm from 101; this season, only 1 from 114. One would think that the bees would proceed to fill up the wire cloth with propolis; but we have had the screen in use two seasons, and they are as clean now as when first put under. We thought they would have to be cleaned at the end of each season, but were pleased to find that they would not. On the left-hand side you will notice that boards are in the open space; these are for use in winter, fall, and spring.

During the honey season we use the wire cloth in its place. By looking closely you will see the grooves in the shelves alongside of each opening; these are for feeding. They are [illegible] of an inch deep, and [illegible] wide. Before using they are varnished with shellac varnish to keep them from leaking, and absorbing the feed, thus keeping them tight, sweet, and clean. The hives are placed on the shelves with the frames running the same way as the shelf; and as the hives are 20 in. long there is about 4 in. between the ends of the hives. The shelves are 28 in. wide from the siding. The groove for feeding is long enough to run from about 2 in. from the inner edge to nearly across the hive. By using quart Mason fruit-jars you can see at a glance from each end of the building how the food is being taken. In using the grooves, place a piece of wire cloth in the groove close up to the hive, and no bees can come out into the building. Feeding with this arrangement has no terrors, and no robbers can bother. The feeder is always ready at a moment's notice. Two grooves are under each hive, and with two quart cans there is a capacity of 6 lbs. at each feed. We have found that one can to each colony is sufficient in ordinary cases. Two cans can be used over each groove, and this will give a capacity of 12 lbs. to each colony. It will be much better to have the shelves gotten out by machinery; and if you think of building, I would give the order to the A. I. Root Co. Mine were made by them; and in ordering, mention "sizes given in order 26,542" with two blocks for each hive, 2 in. long [illegible] thick, and [illegible] wide. Order 26,542 was for 100 colonies. The blocks are to use in the feeders when not in use, to close up the hole under the hives to keep bees in. Looking overhead you see openings in the center, and running the entire length of building, with slides to cover them when not needed.



INTERIOR VIEW OF SALISBURY'S HOUSE-APIARY.

In the winter and summer months they are always open; in the winter, to keep every thing dry, and in the summer to keep down the temperature and carry off the smoke from the smoker. During the spring months, keep them closed.

The first building built had only three openings, each about 8 in. square. These would not carry off the smoke fast enough, and this building was made so there is ample ventilation. Each opening is 2 feet by 10 in., and they are 2 feet apart. All the openings overhead are equal to one opening 35 feet by 10 inches.

The smoke just hustles up and out lively. On the floor there is built a raised floor 12 in. high and 22 in. wide. On each side of this are openings 22 in. long and 6 in wide every 6 feet. The raised floor begins 6 feet from the door, and runs to 6 feet of the honey-room, which is in the center of the building. No flooring is laid under this raised floor. The honey-room is made tight, and has a door in each end of building. Each end holds 60 colonies. Studs are 2 feet apart from center to center, except the second ones from the ends, which are 28 in. from the end. This gives room to handle the corner hives. Rafters are 2×4's, placed exactly over each stud. Collar-beams are 9½ feet from the floor, and are also 2×4's. Over the shelf, and nailed to the studs, are boards about 14 in. wide and ⅜ in. thick. In the winter there is placed another on the inner edge of the shelf, and these boards make a trough in which is packed chaff or planer-shavings The building is ceiled overhead. The entire length is 70 feet, and width 12 feet; cost per running foot, $4.80, or $336 for the building; all work hired. If you do all the work yourself, the cost would be about $90.00 less.

DO BEES DISTINGUISH COLORS?

Bees locate themselves nicely by the colors, very few bees going into the wrong hive or different color. I happened to see something a few days ago that convinced me that bees can tell colors. The north end of the building has no bees in it, but there are 46 in the south end. I noticed that there were bees flying out and in the yellow color in the north end, and thought it was rather funny. I thought that possibly a new swarm had gone in there. I noticed in the south end there was one colony that was flying strongly—young bees out for exercise. They were from the first hive in the yellow toward the north. The bees were also returning, some of them, to the first entrance toward the north in the yellow color in the north end. After the bees in the south end had quieted down, there were no bees going out and in the other in the north end. The entrances were 27 feet apart. This is plain evidence to me that bees can tell colors; and, mind you, they entered the entrance in the north end of the building, and the same relative position of the yellow color, and not any other. F. A. SALISBURY.

Syracuse, N. Y., Aug. 7, 1895.

The only suggestion or improvement that I would make is that the building be made double-walled, and that the space between the two walls be filled with sawdust, planer-shavings, or something of that sort. It would add but very little to the expense, and would probably do away with such winter losses as Mr. Salisbury has experienced during severely cold spells. In other respects the building is very nearly perfect. The work is done inside of the building at any time of day, out of the hot sun; in fact, it may be raining hard outdoors, so far as the apiarist is concerned.

RAUCHFUSS BROTHERS' HOUSE-APIARY NEAR DENVER, COLORADO.

Perhaps it would be proper to remark that, with the ordinary Dovetailed hive described in this work, it would be necessary to have raised rims so as to make a bee-space on top of the boards that are designed to support the hives. This room may be

all the way from ⅜ to one inch thick, depending on the notion of the apiarist.

RAUCHFUSS BROTHERS' HOUSE-APIARY.

The interior and exterior, shown on the following pages, of the Rauchfuss Brothers' house-apiary, will show that it is very similar in its construction to that of F. A. Salisbury. It is much cheaper in its general plan, for it is made of plain ceiled lumber, and lined on the inside with building-paper. In Colorado double walls are not necessary. The arrangement of the shelving will be made apparent from the illustrations showing the interior view.

HOW TO WORK IN THE HOUSE-APIARY.

As soon as you are inside, raise the shutter of the window to let in light. Open the inner door; be sure the screen-door is closed. A little stand or bench may stand in the middle of the room. On this may be placed a screwdriver, honey-knife, and other tools. Open the ventilator so that the smoke will pass out through the roof, and you are ready for business. I have given some hints for extracting, and it only remains to say that the machine should be secured on a stand or box in the center of the room, so that the honey-gate will come over the bung of the barrel. The other stand containing the tools may be set one side. Now, instead of brushing or shaking the bees, as may be done outside, the bee-escape must be used instead. These should be put on the hives the night before, as explained under EXTRACTING and COMB HONEY. Of course, all that remains is to uncap the combs, extract, and put them in

INTERIOR VIEW OF RAUCHFUSS BROTHERS' HOUSE-APIARY.

the supers again. As fast as each super is extracted, remove the board containing the bee-escape, and the bees are ready for business again.

If you are producing comb honey, it may be taken off by means of bee-escapes, in the manner given above. Before the invention of the escape, the nuisance of getting bees out of the sections or off the combs, in the house-apiary, to say nothing of bees all over the floor, and crawling up one's trousers-legs, was such that the house-apiary was any thing but a desirable place in which to keep bees. But now all this is done away with. Of course, during the operation of extracting, a few bees will escape, and get on the window-screens; but they will not remain there long, for they will crawl upward and out. If robbers are bad outside, extracting or taking off comb honey may be managed with perfect impunity inside, and you are not obliged to hunt all over the apiary for combs, giving the pesky scamps a taste at every step. The economy in steps, the immunity from robbers, and protection from the various conditions of weather, are strong points in favor of the house-apiary.

Well, after having finished your work, darken the room by letting down the wooden shutter, and close the ventilator. The few bees that remain inside, that have not already escaped, will find their way out through the little openings in the side of the wall previously described, on the outside of which are the bee-escapes.

WHAT TO DO WITH CROSS COLONIES.

We have always observed that the crossest bees are but little inclined to sting *inside* of a building. When they fly from the combs that you are handling, they find themselves inclosed; and this so disconcerts them that they immediately fly to the screen windows and escape. James Heddon says, "If you have a cross colony, put it in the house-apiary and see how tame it will become."

HOUSE-APIARIES FOR WINTERING.

As the building is double-walled, and is (or ought to be) packed, colonies will require less protection than outdoors. Indeed, about all that will be necessary to put them into winter quarters will be to put on an extra comb-honey super, tuck in a chaff cushion, replace the cover, and then the bees are prepared. In very severe cold weather, a small fire, or heat from a large lamp in the room, may, perhaps, be used to advantage; but the use of artificial heat in wintering should be used sparingly and with care, for oftentimes more harm than good is done.

MOVING WHOLE APIARIES TO MORE NORTHERN LOCALITIES IN ORDER TO STRIKE THE BASSWOOD BLOOM.

During the season of 1884 much was said about moving bees so as to strike the honey-flow; and several experiments were made that seemed to indicate there was no difficulty in making it a success. For instance, we have had a single colony in one day bring in as many as 43 lbs. of honey from the basswood-bloom. Now, this great honey-flow lasts but a few days. If it could be prolonged for months, or even weeks, wonderful things might be done. After the colony above mentioned gave me 43 lbs. of honey in a day, the honey-flow soon gradually went down, and finally stopped altogether. After a lapse of perhaps two weeks, when basswood was entirely gone, and our bees were trying to rob each other's hives, I happened to make a visit in the northern part of Michigan. There I found a brother bee-keeper rejoicing in the height of the basswood season. Now, by moving colonies every ten days or two weeks, so as to strike points where basswood flourishes largely, it seems to me we might secure immense crops of honey.

Within the past few years some progress has been made in this matter, and it now seems that those who have had sufficient experience may successfully bring bees from the South to the North in time to profit by the clover and basswood.

APIS DORSATA. See BEES.

APIARY, OUT. See OUT-APIARIES.

ARTIFICIAL COMB. Several attempts were made to produce artificial honey comb, in the years gone by; but it was not until E. B. Weed, formerly of Detroit, now of Cleveland, O., went to work at the problem that any thing like the real article was produced. His first samples had cell-walls as delicate as the bees make them; but the base was flat, and the bees did not take as kindly to them as their own product. And, moreover, it was soon discovered that they thickened the base, making a comb that, when eaten, showed a perceptible midrib.

Mr. Weed finally set about making the same article with *natural* bases, and this he accomplished perfectly; indeed, it was a marvel of skill and workmanship. This comb was nearly as delicate and as perfect as the natural product, and a good many

pounds of honey were produced with it; that is to say, it was placed in sections as so much drawn comb, in place of that made by the bees. In most cases they filled it promptly, and capped it over; but in other instances it was found that they accepted this comb no more promptly than foundation which could be produced more cheaply. The cost of the dies for making the artificial comb was simply enormous; and, even after they were constructed, the process of making the product was very slow. In view of the fact that the bees would accept almost as readily a deep-cell foundation with *thin* base, as spoken of under COMB FOUNDATION, in this work, Mr. Weed abandoned all attempts at making artificial comb in favor of his new product.

ARTIFICIAL FERTILIZATION. After the reader has read the subject of DRONES, QUEENS, and QUEEN-REARING, he will fully understand that the mating of the drone and queen in a state of nature takes place on the wing in the air, for it never occurs inside of the hive. Nature has seemed to design, for the purpose of avoiding in-breeding, that the queen shall find her mate in the open air, where, according to the law of chance, she will in all probability meet some drone not directly related to her. But attempts have been made at various times to bring about fertilization within the hive or within some small tent, connecting the hive-entrance. But all such attempts have resulted in failure, because the drones and the queens, as soon as they find they are confined in a small inclosure, will bump against the sides of the mosquito-netting or wire cloth, vainly seeking to escape.

There have been some few reports of where success has been accomplished; but they seemed to be from obscure persons who were probably not familiar with the fact that queens will often take several flights in the air before they meet a drone. One might, therefore, put a wire-cloth cage over a hive, and then remove it: the queens and the drones return to the hive: but as both will again seek the air on some future occasion, and meet, our friend the experimenter might conclude that the act of copulation took place in his cage, when in fact it did not occur until at a subsequent time in the air.

Early in 1901 the editor of the *Bee-keepers' Review*, Mr. W. Z. Hutchinson, got track of a man who had apparently succeeded, and how this was done was given in the *Review*. The general plan seemed to be so rational and the author of it so candid that no one was inclined to call it another heresy; for, indeed, Mr. J. S. Davitt, of Aragon, Ga., says emphatically that he succeeded in having 100 queens fertilized to a select lot of drones.

In brief, the plan involves the erection of a tent about 30 feet tall and 30 feet in diameter, the covering being of mosquito-netting. Hives of bees containing select drones are placed around the bottom edge of this tent, each hive having two entrances—one opening into the tent, and the other into the outer air. The last named is covered with perforated zinc so as to allow only the workers to pass, keeping the queens and drones within the hive. The entrance communicating to the *inside* of the tent, or mammoth cage, is kept closed or darkened for about a week; then on some favorable day from 11 to 1:30 it is opened, and the drones are allowed to go into the tent. "After they learn the bounds of their inclosure they seem contented," says Mr. Davitt, "and make a very pretty school flying in the top." When they are thus reconciled the queens also are allowed in the tent from the hives; and, "nine times out of ten, the queen would not reach the top of the tent before receiving the most prompt and gushing attention. . . A queen would leave the mouth of the hive, and return in about five minutes, apparently mated, and in three or four days she would be laying; and the progeny of all queens thus mated showed the same marking as the workers of the colonies from which the drones were taken." Mr. Davitt, as will be noted, accustoms the workers to fly in the open air; they thus become familiar with the *outer* entrance, and use that one only. Then when they are flying the thickest, between 11 and 2 o'clock, the inside entrance is opened and the drones and the queens are allowed to mingle in the tent.

Mr. Davitt lays stress upon the fact that it is a necessary condition that the drones be of the right age. If they are too young they will be of no use. He also says that the *workers* must not be allowed to go into the inner inclosure; for, unlike the drones, they will not submit quietly to the confinement, but bump their heads against the netting, vainly seeking to escape, and by so doing demoralize the drones. The whole secret of the plan seems to consist in having a large tent, keeping workers out, and having drones trained to regard the inclosure as the absolute limit of their flight, and therewith to remain content.

So far as I know now, no one has tried this except Mr. Davitt; but one, and possibly two, experiment stations are planning to put up enormous cages like the one described; and if the plan proves to be a success it will be a great boon to the bee-keeping industry. So far it has not been feasible to control more than one parentage in the rearing of queens, and that the mother No matter how choice the queen may be, nor how excellent her stock, yet she may mate in the open air with a drone from very inferior stock. In the breeding of domestic animals it is possible to mate together a choice male and a choice female. Much could be accomplished in the way of improved stock if we could also control the male parentage of bees; and I do not know but that in-breeding, according to modern methods now known in stock-raising, might secure for use a race of bees greatly superior to any thing we now know.

Just at present it seems very desirable that bees with longer tongues be bred, so that the nectar in the deep corolla-tubes of red clover, in the horsemint of Texas, and the mountain sages of California, as well as of hundreds of other flowers, could be reached. Tons and tons of honey might thus be secured that otherwise goes to waste. See TONGUE OF WORKER BEE.

ARTIFICIAL HEAT. As strong colonies early in the season are the ones that get the honey and furnish the early swarms as well, and are in fact the real source of profit to the bee-keeper, it is not to be wondered at that much time and money have been spent in devising ways and means whereby all might be brought up to the desired strength in time for the first yield of clover honey. As market-gardeners and others hasten the early vegetables by artificial heat, or by taking advantage of the sun's rays by means of greenhouses, etc., it would seem that something of the kind might be done with bees; in fact, we have, by the aid of glass and the heat of a stove, succeeded in rearing young bees every month in the year, even while the weather was at zero, or lower, outside; but so far as we can learn, all artificial work of this kind has resulted in failure, so far as profit is concerned. The bees, it is true, learned to fly under the glass and come back to their hives; but for every bee that was raised in confinement, two or three were sure to die, from one cause or another, and we at length decided it was best to wait for summer weather, and then take full advantage of it.

Later, we made experiments with artificial heat while the bees were allowed to fly out at pleasure; and although it seemed at first to have just the desired effect, so far as hastening brood-rearing was concerned, the result was, in the end, just about as before; more bees were hatched, but the unseasonable activity, or something else, killed off twice as many as were reared, and the stocks that were let alone in the good old way came out ahead. Since then I have rather endeavored to check very early brood-rearing, and, I believe, with better results.

A few experiments with artificial heat have apparently succeeded, and it may be that it will eventually be made a success; but my impression is, that we had much better turn our energies to something else, until we have warm settled weather. Packing the hives with chaff, sawdust, or any other warm, dry, porous material, so as to economize the natural heat of the cluster, seems to answer the purpose much better, and such treatment seems to have none of the objectionable features that working with artificial heat does. The chaff needs to be as close to the bees as possible; and to this end, we would have all the combs removed except such as are needed to hold their stores. Bees thus prepared seem to escape all the ill effects of frosty nights in the early part of the season, and we accomplish for brood-rearing exactly what was hoped for by the use of artificial heat.

For the benefit of those who may be inclined to experiment, I would state that I covered almost our entire apiary with manure, on the plan of a hot-bed, one spring, and had the satisfaction of seeing almost all die of spring dwindling. At another time I kept the house-apiary warmed up to a summer temperature with a large oil-lamp, for several weeks, just to have them beat those out of doors. The investment resulted in losing nearly all in the house-apiary with spring dwindling, while those outside stayed in their hives as honest bees should, until settled warm weather, and then did finely, just because I was "too busy to take care of them" (?), as I then used to express it. After you have had experience enough to count your profitable colonies by the hundred, and your crops of honey by the ton, it will do very well to experiment with greenhouses and cold-frames; but beginners had better let such appliances alone, unless they have plenty of money to spare for more bees.[28]

ARTIFICIAL PASTURAGE. Although there used to be quite a trade in seeds

and plants to be cultivated for their honey alone, I can give little encouragement to those who expect to realize money by such investments. There is certainly a much greater need of taking care of the honey that is almost constantly wasting just for lack of bees to gather it. A field of buckwheat will perhaps occasionally yield enough honey to pay the expense of sowing, as it comes in at a time when the bees in many places would get little else; and if it does not pay in honey, it certainly will in grain. If one has the money, and can afford to run the risk of a failure, it is a fine thing to make some accurate experiments, and it may be that a farm of one or two hundred acres, judiciously stocked with honey-bearing plants, trees, and grains, would be a success financially. It has been much talked about, but none, so far as we know, have ever put the idea in practice. To beginners I would say: Plant and sow all you can that will be sure to pay aside from the honey crop, and then, if the latter is a success, you will be so much ahead; but beware of investing much in seeds that are for plants producing nothing of value except honey. Alsike and white Dutch clover, buckwheat, rape, alfalfa, and the like, it will do to invest in; but catnip, mignonnette, Rocky-Mountain bee-plant, etc., etc., I would at present handle rather sparingly. It should be borne in mind that we can hardly test a plant, unless we have one or more *acres* of it in bloom, and that small patches do little more than to demonstrate that the blossoms contain some honey, giving us very little clue to either quantity or quality. Bees will work on blossoms, and at times with great apparent industry, when they are obliged to make hundreds of visits and consume hours of time in getting a single load; we therefore should be intimately acquainted with the interior of the hive, as well as the source from which the bees are obtaining the honey, before we can decide what is profitable to sow as a honey-plant.

The question, "How many acres of a good honey-bearing plant would be needed to keep 100 colonies busy?" has often been asked. If ten acres of buckwheat would answer while in full bloom, we should need perhaps ten other similar fields sown with rape, mustard, catnip, etc., blossoming at as many different periods, to keep them going the entire warm season. It would seem 500 acres should do nicely, even if nothing were obtained from other sources, but at present we can only conjecture. A colony of bees will frequently pay for themselves in ten days during a good yield from natural pasturage; and if we could keep up this state of affairs during the whole of the summer months, it would be quite an item indeed. Buckwheat, rape, and alsike clover, are the only cultivated plants that have given paying crops of honey, without question, so far as we have been informed. See HONEY-PLANTS in Index.

ASTERS. Under this head we have a large class of autumn flowers, most of which are honey-bearing; they may be distin-

ASTER.

guished from the helianthus, or artichoke and sunflower family, by the color of the ray flowers. The ray flowers are the outer colored leaves of the flower, which stand out like rays; in fact, the word aster means star, because these ray flowers stand out like the rays of a star. Many of the yellow autumn flowers are called asters, but this is an error; for the asters are never yellow, except in the center. The outside, or rays, are blue, purple, or white. You may frequently find half a dozen different varieties growing almost side by side. Where there are many acres of them, they sometimes yield considerable honey, but some seasons they seem to be unnoticed by the bees. Better move your bees to where they grow naturally, when you have determined by moving a single hive first, as a test, whether they are yielding honey in paying quantities.

Where the asters and goldenrod abound largely, it may be best to defer feeding until these plants have ceased to yield honey, say the last of September.

B.

BARRELS. The regular size used for the storage and shipping of honey is anywhere from 31 to 32 gallons. The large barrels of 45 or 50 gallons capacity, however, are a little too heavy. Being very unwieldy they are liable to be broken or jammed by freight-handlers in shipping. As to the kind of barrel, the second-hand alcohol or whisky barrels that can be obtained at the drugstores may be used, providing they are not charred on the inside. The ordinary alcohol-barrel is gummed or glazed on the inside with a preparation of glue that does not dissolve. As a general rule, whisky-barrels are charred, and are unsuitable, and before taking any barrels of any kind it is very necessary to determine what the character of the lining is on the inside. Molasses or syrup barrels may be used, but should be thoroughly cleansed; but barrels that have a sour or musty smell should not be considered for a moment. Even if cleaned they might taint and ruin the honey.

Charles Dadant & Son, of Hamilton, Ill., large producers of extracted honey, recommend the following plan for cleaning the barrel when it is desired to do a thorough job:

First mark the head and the chime, or end of staves, with a chisel or some sharp instrument, so that you may find the exact position occupied by the head when putting it back. Mark two places so as to make sure. Then take a large gimlet and screw it into the middle of the head for a handle, taking care not to pierce the head through. Then remove all the hoops except the top one. They may also be marked if necessary, so as to be returned to the same position. When all are removed but one, have some one hold the head by help of the gimlet until the last hoop is off. When the barrel has been cleaned, put the head back in the same position.

After the barrel has been cleaned it should be put in a dry place, so that it will dry out thoroughly, inside and out; and this reminds me that you should never use old barrels, the wood of which has become soaked with water; for honey has the quality of absorbing moisture from the wood; that is to say, a wet barrel filled with honey will actually become dry. The staves shrink, and then, of course, the honey leaks out. If one does a large business in shipping honey in barrels he should buy new ones. The staves should be made of sound kiln-dried stuff; and nothing but iron hoops, not wooden ones, should be used. The barrels should be kept in dry places, and then, before using, they should be well coopered and tested, as will be explained.

KEGS.

Wooden packages holding from 100 to 150 lbs. are used quite extensively in some parts of the East. They are usually made of cypress, and, when well made, make a very good package. The general directions that apply to barrels will apply with equal force to kegs.

BARRELS THE FREQUENT CAUSE OF COMPLAINT.

It may be said that no slovenly, careless, or slipshod bee-keeper should use barrels. He will be too careless to see that they are tight. He will put his honey into them, ship them, and in all probability the barrels will begin to leak *en route;* and he will receive a complaint from the consignee that "the honey arrived in bad condition," "half of it gone." There have been more ill feelings and hard words because of the inexcusable carelessness or lack of proper knowledge concerning this matter of shipping honey in barrels than, perhaps, any other one thing connected with the marketing of honey. If the directions I have given are carefully followed, and good barrels are selected, there will be little or no trouble.

Another frequent source of complaint arises from the fact that the barrels are filled too full. Honey, during the process of candying, will expand. If it is put into the barrel long before it is candied, the barrel should not be filled quite full. Just before shipping put in a little more and then ship. We have received several consignments of honey in barrels, that had candied. The barrels had been filled full, the honey had candied, and burst the barrel, with the result that we have had some bad messes at our depot.

HOW TO TEST BARRELS FOR LEAKING.

Barrels that are intended for the storage of honey should not be kept in a cellar but in a *dry place.* Before filling, the hoops should be driven down tight all around. To test for leakage, Mr. N. E. France, Platte-

ville, Wis., a bee-keeper of large experience, recommends the following plan:

Drive one of the bungs in, and then with the mouth placed tightly over the bunghole blow in until there is quite a pressure in the barrel. To do this, place the mouth over the hole, exhaust the lungs, draw in a fresh supply through the nose, exhaust the lungs again, and so on until you have forced in all the air possible. Place the side of the palm next to the mouth, then with a quick sliding motion move the mouth simultaneously with the palm, and close the opening. Now listen for any air-leaks. If there are any there will be a hissing in one or more places. Dip the free hand into some water, and push it along to where the air seems to be hissing out. This will prove beyond a doubt whether there is a leak at that point. If there is one there will be a sputtering or bubbling. Note the place, and then hunt for other leaks. But all this time, of course, the palm of one hand should be held over the bung through which the air was forced. Wherever the air is found leaking through, drive the hoops down still further until the openings are closed. Then, again, force air into the barrel and try for leaks as before. If no more hissing can be heard, and the pressure of air in the barrel seems to hold, it may be considered tight.

Do not, under any circumstances, test a barrel for leakage with water, as it soaks up the wood, and the latter would swell up and close the leak. After the honey is put into the ba rel it would absorb the water, and the barrel would leak just at a time when it could be least afforded, when it would be half way on its journey.

THE NEED OF PARAFFINING OR WAXING BARRELS.

I am well aware that some of our best honey-producers say it is not necessary to wax or paraffine barrels inside; but our experience shows that it is very important, not so much for the purpose of closing up any possible leaks as to prevent the honey from soaking into the wood of the barrel; or the wood itself from giving a taint to the honey. The average person has little idea of the amount of honey that may be soaked up inside of an unwaxed barrel, and this last is charged up to the shipper. After having tested the barrel for leaks by the air-pressure plan recommended, and made it tight, wax or paraffine the inside of the barrel; but don't depend on the waxing to close up the leaks—the barrel should be tight before.

Paraffine is a good deal cheaper than beeswax, and melts at a lower temperature, and it is, therefore, to be recommended. Melt up about 10 or 12 lbs., and when it is quite hot pour it through a large tunnel into one of the bungholes of the barrel. Quickly drive in the other bung, roll it around, twirl it on each head; then give it another spinning so as to cover perfectly all around the chime. This operation will warm the air inside to such an extent that the liquid will be forced into every crevice. As soon as the inside is covered, loosen the bung with a hammer; and if the work is well done the bung will be thrown into the air with a loud report. Pour out the remaining liquid, warm it up again, and treat the other barrels in a like manner.

The operation as a whole takes but very little time; and if one has taken pains to make the barrel tight by the air-pressure plan, the coating of paraffine on the inside will make it doubly secure. Second-hand barrels especially should be paraffined; and even new barrels should be so treated to prevent a great loss of honey that would necessarily soak into the wood.

BARRELS OR SQUARE CANS.

In California, Colorado, and other hot dry States, barrels and kegs should never be used. The ordinary 60-pound tin cans, described under EXTRACTED HONEY, are the only suitable shipping-packages. Indeed, they are the only package that nine-tenths of the bee-keepers of this land can use safely. While they cost considerably more per pound, yet the honey is nearly always reported as going through in good order. Even if one has a hole punched in it, only 60 pounds of honey is lost; while in the case of a leak or a break in a barrel, anywhere from five to eight times that amount is wasted. Through the entire West—and that is where the great bulk of the extracted honey in the United States is produced—the square tin can, two in a case, is used exclusively; and I would strongly urge the average bee-keeper to use them in preference to barrels. While the tin package costs a little more per pound, it usually brings a little more on the market; for the buyer can take as large or small a quantity as he needs. If the purchaser hesitates to buy a whole barrel of honey for his own local trade, he would readily take one or more cans of 60 pounds each.

REMOVING CANDIED HONEY FROM BARRELS.

Good thick honey will usually become solid at the approach of frosty weather, and

perhaps the readiest means of getting it out of the barrel in such cases is to remove one of the heads, and take it out with a scoop. If it is quite hard, you may at first think it quite difficult to get a scoop down into it; but if you press steadily, and keep moving the scoop slightly, you will soon get down its whole depth. If the barrel is kept for some time near the stove, or in a very warm room, the honey will become liquid enough to be drawn out through a large-sized honey-gate.

A more wholesale way of removing candied honey is to set the barrel or keg in a tub or wooden tank of water. The latter is kept hot by a small steam-pipe. In 24 or 36 hours the honey in the barrel will be melted, and can then be drawn out in the usual way.

BASSWOOD. With perhaps the single exception of white clover, the basswood, or linden, as it is often called, furnishes more honey than any other one plant or tree known. It is true, that it does not yield honey every season, but what plant or tree does?[31] It occasionally gives us such an immense flood of honey that we can afford to wait a season or two, if need be, rather than depend on sources that yield more regularly, yet in much smaller amounts. If a bee-keeper is content to wait—say ten or fifteen years for the realization of his hopes; or if he has an interest in providing for the bee-keepers of a future generation, it will pay him to plant basswoods. A tree that was set out about ten years ago, in one of our streets, now furnishes a profusion of blossoms, almost every year; and from the way the bees work on them I should judge it furnished considerable honey. A hundred such trees in the vicinity of an apiary would be, without doubt, of great value. See ARTIFICIAL PASTURAGE. Our 4000 trees were planted in the spring of 1872, and in 1877 many of them were bearing fair loads of blossoms. We made some experiments with basswood seeds, but they proved mostly failures, as have nearly all similar ones we have heard from. By far the better and cheaper way is to get small trees from the forest. These can be obtained in almost any quantity, from any piece of woodland from which stock have been excluded. Cattle feed upon the young basswoods with great avidity, and pasturing our woodlands is eventually going to cut short the young growth of these trees from our forests, as well as of many others that are valuable. We planted trees all the way from one to ten feet in height. The larger ones have, as a general rule, done best.

The cut will enable any one to distinguish at once the basswood when seen. The clusters of little balls with their peculiar leaf attached to the "seed-stems" are to be seen hanging from the branches the greater part of the summer, and the appearance, both before and after blossoming, is pretty much the same. The blossoms are small, of a light yellow color, and rather pretty; the honey is secreted in the inner side of the thick fleshy petals. When it is profuse it will sparkle like dewdrops if a cluster of blossoms is held up to the sunlight.

Climatic influences have their effect upon basswood. Among the hills of York State the leaves assume mammoth proportions. I measured one that was 14 in. long.[323] While this leaf was among the largest, yet the leaves were, on the average, about twice the size of those in our own locality. In Illinois I noticed that the basswoods seemed to be less thrifty than in Ohio. The leaves seemed to be smaller, and the bark of the trees of a little different appearance. The preceding engraving represents quite accurately the typical forms, however. The European variety has smaller leaves, and differs from *Tilia Americana* in a few other minor respects.

It is rather to be regretted that this tree is not more plentiful than it is. It is one of the main stays, where it grows, of the honey-producer, and one of the most valuable woods in manufacture. It will hardly do for outside exposure to the weather; but it is admirably adapted for packing-boxes, and is used in *immense* quantities in the manufacture of furniture, forming the bottoms and sides of drawers, the backs of bureaus, dressing-cases, etc., and it is also employed extensively in the manufacture of paper; in fact, the envelopes that are sent out from the Home of the Honey-bees are said to be made from basswood "pulp."

It has often been said that we are cutting off our own noses in using it for one-piece sections—that we are "killing the goose that lays the golden egg." Well, it is true that apiarian-supply dealers may use quite a little; but still, the amount that *they* use is very insignificant in comparison with that employed by furniture-makers, packing-box concerns, and paper-makers.

After all, there is one redeeming feature. The basswood is a very rapid grower. We thought at one time that we had used about all the basswood in this section, to say noth-

ing of the enormous quantities shipped in from Michigan and other States. But somehow the farmers bring in beautiful nice white basswood lumber; and where they get it in our vicinity is a sort of puzzle. At least some of this lumber is from a second growth of trees that sprouted ten years ago from the stumps of old trees—said trees having been cut for us ten years ago. *If* basswood will replace itself in ten or even twenty years, so that it can be used again for lumber, there is yet hope that it may continue to bless the bee-keeper.

But over against this is the stubborn fact

AMERICAN BASSWOOD, OR LINDEN.

that our basswoods are disappearing, and rapidly, too, all over the country. During 1899, when there was such a great advance in pine lumber, basswood was used very largely for house-building, with the consequence that millions of feet were used.

Basswood, and perhaps most other forest-trees, require shade, especially when young; and, much to our surprise, some that were planted directly under some large white-oak trees have done better than any of the rest.

AMERICAN BASSWOOD, OR LINDEN.[32]

Who has not noticed exceedingly thrifty basswoods growing in the midst of a clump of briers and bushes of all sorts? I would place the trees not more than 12 feet apart, for it is an easy matter to thin them out whenever they are found too close. A neighbor has planted basswoods entirely round his farm on the road-sides, and they add much to the comfort of travelers, are pretty to the sight, and, without doubt, will furnish honey enough, in time, to pay all expenses.

The best yield of honey we have ever had from a single hive, in one day, was from the basswood bloom; the amount was 43 lbs. in three days.[31] The best we ever recorded from clover was 10 lbs. in one day. The honey from the basswood has a strong aromatic or mint flavor, and we can tell when the blossoms are out by the perfume about the hives. The taste of the honey also indicates to the apiarist the very day the bees commence work on it. The honey, if extracted before it is sealed over, when it is coming in rapidly, has the distinctive flavor so strong as to be very disagreeable to some persons. My wife likens it to the smell and taste of turpentine or camphor, and very much dislikes it, when just gathered; but when sealed over and fully ripened in the hive, she thinks it delicious, as does almost every person.

BEE-BREAD. A term in common use, applied to pollen when stored in the combs. In olden times, when bees were killed with sulphur to get at the honey, more or less pollen was usually found mixed with the honey; it has something of a "bready" taste, and hence, probably, came its name. Since the advent of the extractor and section boxes, it is very rare to find pollen in the honey designed for table use. See POLLEN.

BEE-DRESS. See VEILS.

BEE-ESCAPES. See COMB HONEY, also EXTRACTING.

BEES AND GRAPES. Nearly every year the bee-keepers are met with complaints from their neighbors about how the bees are eating up their grapes. It has been pretty well established that bees never touch the perfectly sound fruit; and until recently it was supposed by all fruit-growers, and even by some bee-keepers, that bees made a small round puncture through the skin of some soft grapes like the Niagara, and even pierced the more hardy Concords. But more recently we were successful in finding the real culprit, and that was in the form of a little bird, quick of flight, scarcely if ever to be seen around the vines when any human being was present. This bird, about the size of a sparrow, striped, and called the Cape May warbler (*Dendroica tigrina*), has a long sharp needle-like beak. It will alight on a bunch, and, about as fast as one can count the grapes, will puncture berry after berry. After his birdship has done his mischief he leaves, and then come on innocent bees to finish the work of de-

struction by sucking the juices of the pulp of the berry, finally leaving it dry and withered up. While the birds are scarcely ever "caught in the act," the bees, ever present during all the hours of daylight, receive all the credit for the mischief.

Grapes broken in handling will be visited by bees independently of any tampering on the part of the feathered tribe; and at such times bees do very often prove to be quite a nuisance; but it may be said, on the other hand, that broken grapes are unsalable anyhow, and therefore this damage is slight if any, and the real mischief or harm done is simply the annoyance caused by the fear of being stung while handling over the bunches in the basket.

But the Cape May warbler is not the only little culprit guilty of puncturing grapes. There is a large class of birds that have learned this wicked habit, and among them may be named the sparrow; but usually this bird is not the one, as in the majority of cases it seems not to have learned the trick.

Another bird that punctures grapes about the same as the Cape May warbler is what is known as the Baltimore oriole—a beautiful bird of brilliant plumage, and a sweet singer—sometimes called the "swinging bird," from its habit of building its nest from some overhanging limb of a tree. It pierces the grapes in the same way as the Cape May warbler, leaving the bees to finish the work of destruction. There are other birds, like the robins, yellow-hammers, and woodpeckers that eat grapes, but their depredations are so very pronounced that the bees are not blamed for their mischief as is the case with the Cape May warbler and the Baltimore oriole.

For further information regarding grape-puncturing birds, write to Dr. Merriam, of the U. S. Department of Agriculture, Washington, D. C.

BEE-HUNTING. I have given the warning so often, against leaving sweets of any kind about the apiary, and about being careful not to let the bees get to robbing each other, that it may seem a little queer to be directed how best to encourage and develop this very robbing propensity in these little friends of ours.

The only season in which we can trap bees is when they will rob briskly at home; for when honey is to be found in the flowers in plenty, they will hardly deign to notice our bait of even honey in the comb. Before starting out, it will be policy to inform yourself of all the bees kept in the vicinity, for you might otherwise waste much time in following lines that lead into the hives of your neighbors. You should be at least a mile from any one who has a hive of bees when you commence operations, and it were safer to be two miles. I do not mean by this to say that there are no bee-trees near large apiaries, for a number have been found within half a mile of our own, and an experienced hand would have but little trouble in finding more, in all probability; but those who are just learning would be very likely to get very much perplexed and bothered by domesticated bees mixing with the wild ones.

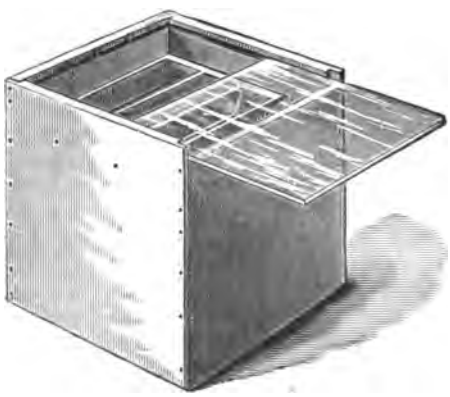
Perhaps the readiest means of getting a line started is to catch the bees that will be found on the flowers, especially in the early part of the day. Get them to take a sip of the honey you have brought for the purpose, and they will, true to their instinctive love of gain, speed themselves home with their load, soon to return for another. To find the tree, you have only to watch and see where they go. Very simple, is it not? It certainly is on paper, but it usually involves a deal of hard work when carried out in practice. You can get along with very simple implements; but if your time is valuable, it may pay to go out fully equipped. For instance, a small glass tumbler will answer to catch bees with; and after you have caught one, you can set the glass over a piece of honey-comb. Now cover it with your handkerchief to stop its buzzing against the glass, and it will soon discover the honey, and load up. Keep your eye on it; and as soon as it is really at work at the honey gently raise the glass and creep away, where you may get a good view of proceedings. As soon as it takes wing, it will circle about the honey, as a young bee does in front of the hive, that it may know the spot when it comes back; for a whole "chunk" of honey, during the dry autumn days, is quite a little gold-mine in its estimation. There may be a thousand or more hungry mouths to feed, away out in the forest in its leafy home, for aught we know.

If you are quick enough to keep track of its eccentric circles and oscillations, you will see that its circles become larger and larger, and that each time it comes round it sways to one side; that is, instead of making the honey the center of its circles, it makes it almost on one edge, so that the last few times it comes round it simply comes back after it has started home, and throws a loop, as

it were, about the honey to make sure of it for the last time. Now you can be pretty sure which way its home lies almost the very first circuit it makes, for it has its home in mind all the time, and bears more and more toward it.

If you can keep your eye on it until it finally takes the "bee-line" for home, you do pretty well, for a new hand can seldom do this. After it is out of sight, you have only to wait until it comes back, which it surely will do, if honey is scarce. Of course, if its home is near by, it will get back soon; and to determine how far it is, by the length of time it is gone, brings in another very important point. The honey that the bees get from the flowers is very thin; in fact, it is nearer sweetened water than honey, and if you wish a bee to load up and fly at about a natural "gait," you should give it honey diluted with water to about this consistency. Unless you do, it will not only take a great deal more time in loading up, but the thick honey is so much heavier it will very likely stagger under the load, and make a very *crooked* bee-line of its homeward path. Besides, it will take much more time to unload. Sometimes, after circling about quite a time, it will stop to take breath before going home, which is apt to mislead the hunter unless he is experienced; all this is avoided by filling your honey-comb with honey and water, instead of the honey alone.

Now, it takes quite a little time to get a bee caught and started in the work; and that we may be busy, we will have several bees started at the same time; and to do this expeditiously, we will use a bee-hunting box made as in the following cut.



BOX FOR BEE-HUNTING.

This is simply a light box about 4¼ inches square; the bottom is left open, and the top is closed with a sheet of glass that slides easily in saw-cuts made near the upper edge. About a half-inch below the glass is a small feeder, quite similar to the one figured in FEEDING AND FEEDERS.

HOW TO USE THE HUNTING-BOX.

Take with your box about a pint of diluted honey in a bottle. If you fill the bottle half full of thick honey, and then fill it up with warm water, you will have it about right. In the fall of the year you will be more likely to find bees on the flowers in the early part of the day. When you get on the ground, near some forest, where you suspect the presence of wild bees, pour a little of your honey into the feeder, and cautiously set the box over the first bee you find upon the flowers. As soon as the box is well over the flower, close the bottom with your hand, and it will soon buzz up against the glass. Catch as many as you wish, in the same way, and they will soon be sipping the honey. Before any have filled themselves, ready to fly, set your box on some elevated point, such as the top of a stump in an open space in the field, and draw back the glass slide. Stoop down now, and be ready to keep your eye on one, whichever way it may turn. If you keep your head low, you will be more likely to have the sky as a background. If you fail in following one, you must try the next; and as soon as you get a sure line on one, as it bears finally for home, be sure to mark it by some object that you can remember. If you are curious to know how long they are gone, you can, with some white paint in a little vial, and a pencil-brush, mark one of them on the back.* This is quite a help where you have two or more lines working from the same bait. When a bee comes back, you will recognize it by the peculiar inquiring hum, like robbers in front of a hive where they have once had a taste of spoils. If the tree is near by, each one will bring others along in its wake, and soon your box will be humming with a throng so eager that a further filling of the feeder from the bottle will be needed. As soon as you are pretty well satisfied in which direction they are located, you can close the glass slide

*Since this was written, an A B C scholar says: "Bees vary in their flight. But I have found that on an average they will fly a mile in five minutes, and spend about two minutes in the hive or tree. Of course, they will spend more time in a tree when they have to crawl a long distance to get to the brood-nest, hence we may deduce the rule: Subtract two from the number of minutes absent, and divide by ten. The quotient is the number of miles from the stand to the tree. (See GLEANINGS, 1887, page 431.) This applies to a partially wooded country. Perhaps in a clearing they could make better time. On a very windy day it takes them longer to make trips."

and move along on the line, near to the woods. Open the box, and you will soon have them just as busy, again; mark the line and move again, and you will very soon follow them to their home. To aid you in deciding just where they are, you can move off to one side and start a cross-line.† Of course, the tree will be found just where these lines meet; when you get where you think they should be, examine the trees carefully, especially all the knot-holes, or any place that might allow bees to enter and find a cavity. If you place yourself so that the bees will be between you and the sun, you can see them plainly, even if they are among the highest branches. Remember you are to make a careful and minute examination of every tree, little and big, body and limbs, even if it does make your neck ache. If you do not find them by carefully looking the trees over, go back and get your hunting-box, bring it up to the spot, and give them feed until you get a quart or more at work. You can then see pretty clearly where they go. If you do not find them the first day, you can readily start them again almost any time, for they are very quick to start, when they have once been at work, even though it is several days afterward.

Bees are sometimes started by burning what is called a "smudge." Get some old bits of comb containing bee-bread as well as honey, and burn them on a small tin plate, by setting it over a little fire. The bees will be attracted by the odor of the burning honey and comb, and, if near, will sometimes come in great numbers. Oil of anise is sometimes used, to attract them by its strong odor. We have had the best success in getting them from the flowers as we have directed.

A spy-glass is very convenient in finding where the bees go in, especially if the tree is very tall; even the toy spy-glasses sold for 50c. or a dollar are sometimes quite a help. The most serviceable, however, are the achromatic opera glasses that cost from $3.00 to

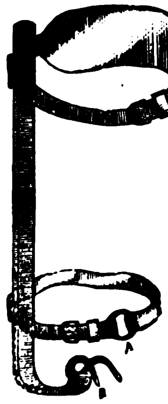
A BEE-TREE IN AN OHIO WOODS.

$5.00. With these we can use both eyes, and the field is so broad that no time is lost in getting the glass instantly on the spot. We can, in fact, see bees with them in the tops of the tallest trees, almost as clearly as we can see them going into hives placed on the ground.

After you have found the tree, I presume you will be in a hurry to get the bees that

† The same writer says further: "It is a waste of time to look for the bee-tree, or to make cross-lines, until you get beyond the tree. When the bees fly back on the line, you may rest assured that you are beyond the tree. Move your last two stands closer together (lining the bees carefully), so that they are only ten or fifteen rods apart. Now, as you have bees flying from two directions into the tree you will probably discover where they are immediately. But if you fail to find them easily, take a stand off to one side, eight or ten rods, and cross-line. This is the only place that I find a cross-line of any advantage."—*See Gleanings in Bee Culture, Vol. XV., page 771.*

you know are there, and the honey that *may* be there. Do not fix your expectations too high, for you may not get a single pound of the latter. Of two trees that we took a few years ago, one contained just about as much honey as we had fed them, and the other contained not one visible cell full! The former were fair hybrids, and the latter well-marked Italians. If the tree is not a valuable one, and stands where timber is cheap and plentiful, perhaps the easiest way may be to cut it down. This may result in a mashed-up heap of ruins, with combs, honey, and bees all mixed up with dirt and rubbish, or it may fall so as to strike on the limbs or small trees, and thus ease its fall in such a way as to do very little injury to the hive or the forest. The chances are rather in favor of the former, and on many accounts it is safer to climb the tree and let the bee-hive down with a rope. If the hollow is in the body of the tree, or so situated that it can not be cut off above and below, the combs may be taken out and let down in a pail or basket; for the brood-combs, and such as contain but little honey, the basket will be rather preferable. The first thing, however, will be to climb the tree; and as I should be very sorry to give any advice in my A B C book that might in any way lead to loss of life, I will, at the outset, ask you not to attempt climbing unless you are, or can be, a very careful person. An old gentleman who has been out with us remarked that he once knew a very expert climber who took all the bees out of the trees for miles around, but was finally killed instantly, by letting his hands slip, as he was getting above a large knot in the tree. We do not wish to run any risks, where human life is at stake.



CLIMBERS FOR BEE-HUNTERS.

For climbing trees 12 or 18 inches in diameter, a pair of climbers are used, such as are shown above.

The iron part is made of a bar 18 inches long, 3/4 wide by 1/4 thick. At the lower end it

CLIMBING A BEE-TREE, 88 FEET FROM THE GROUND.

is bent to accommodate the foot as shown, and the spurs are made of the best steel, carefully and safely welded on. These points should be sharp, and somewhat chisel-shaped, that they may be struck safely into the wood of the tree; the straps will be readily understood by inspection. When in use, the ring A is slipped over the spur B, and the straps are both buckled up safely. If the tree is very large, the climber provides himself with a tough withe or whip, of some tough green bough, and bends this so it will go around the trunk, while an end is held in each hand. As he climbs upward, this is hitched up the trunk. If he keeps a sure and firm hold on this whip, and strikes his feet into the trunk firmly, he can go up the most forbidding trees, rapidly and safely. A light line, a clothes-line for instance, should be tied around his waist, that he may draw up such tools as he may need. The tools needed are a sharp ax, hatchet, saw, and an auger to bore in to see how far the hollow extends. If the bees are to be saved, the limb or tree should be cut off above the hollow, and allowed to fall. A stout rope may be then tied about the log hive, passed over some limb above, the end brought down and wrapped about a tree until the hive is cut off ready to lower. When it is down, let it stand an hour or two, or until sundown, when all the bees will have found and entered the hive. Cover the entrance with wire cloth, and take it home.

There are some trees, indeed, so large that it would be impossible to climb them with the implements already given. A very ingenious plan, however, has been put into execution by Mr. Green Derrington, of Poplar Bluff, Mo. I give his description, together with a couple of engravings made from photographs which he sent.

I send you photographs of some large trees, which I climbed by means of spikes and staples. To prevent the possibility of falling I put a belt under my arms. To this I attached two chains. At the end of each chain is a snap. My method of climbing is as follows: After ascending the ladder as far as I can go I drive into the side of the tree a large bridge spike, far enough into the wood to hold my weight. A little further up I drive another spike. In between the spikes I drive the first staple, and to this I attach the first chain by means of the snap, and ascend by the nails as far as the chain will allow me; I then drive another staple, and attach the other chain, and next loosen the lower snap. After driving in more spikes, I again ascend as high as the chain will allow me, and attach the other chain to another staple. In this manner I can make my ascent with perfect security.

The tree in the first picture is 7 feet in diameter at the foot. If you will follow all along up the body of the tree, just above the crotch on the right limb you will see your humble servant, 88 feet from the ground. The tree stands close to the Black River, in a graveyard, and from it I obtained 50 lbs. of honey. Your climbers are excellent for small trees, say from two to three feet in diameter; but the tree illustrated has such a rough and uneven bark, and is so large, that it would be difficult to climb it without the aid of spikes and the staples I have men-

ANOTHER BEE-TREE, 11 FEET IN DIAMETER, CLIMBED BY GREEN DERRINGTON.

tioned. On account of the large knots it would be impossible to use a rope, or something similar, to hitch up by climbers, as described in the A B C book. Knots are not in my way when I use spikes and staples. GREEN DERRINGTON.

Poplar Bluff, Butler Co., Mo.

If you want only the honey, and do not care for the bees, you can slab off one side of the hollow, cut out the combs, and let them down in pails. The bees can very often be saved in this way, as well as the honey. Fix the brood-combs about the right distance apart, in a pail or basket; the bees will in time collect about them, and may then, toward dark, be carried safely home. Many bee-hunters brimstone the bees; but I am so averse to any such method of killing bees, that I have not even the patience to describe it. Sometimes the hollow is below the limbs; in this case the climber passes a surcingle about him, under his arms, around the tree, and in this position chops the bees out. I have said nothing about smoke or veils; for so far as my experience goes, none seem to be needed. The bees become so frightened by the chopping that they are perfectly conquered, and cease entirely to act on the offensive.

Once when we had cut down a bee-tree, a whole flock of schoolchildren rushed out to see the fun, for the country schoolhouse was near at hand. Although the children fairly hovered over the tree, bees flying all about in the air, and crawling all over the place which had once been their home, not one of them offered to sting. They were so completely demoralized that they could be handled just like so many flies. Of course, when one was pinched it would sting. In the picture shown, the bee-men or bee-hunters wore veils. The anomaly of the situation of the protected experts and unprotected children was not discovered until after the camera had done its work. The fact was, the veils were needed immediately after the falling of the tree, but not a few minutes afterward.

After you have got them down where the combs can be reached, the usual directions for transferring are to be followed. A bee-keeper who has a taste for rustic work might set the log up in his apiary, just to show the contrast between the old style of bee-keeping and the new. Some very interesting facts are to be picked up in bee-hunting. One of the trees we once cut contained comb as much as a yard long, and not more than 8 inches wide in the widest part. It has been said, that bees in a state of nature select cavities best adapted to their needs. I am inclined to think this very poor reasoning. If a farmer allowed nature to take care of his corn-fields, he would get a very poor crop; and from what I have seen of bee-trees, I should judge the poor fellows need to be taken care of, almost as much as the corn. We often get 100 lbs. of comb

A BEE-TREE LAID LOW, SHOWING CAVITY THAT FORMERLY HELD THE BEES.

honey from a hive, but I never knew a bee-tree to give any such amount, as the product of a single season. We sometimes find quite a quantity of honey in a tree, it is true; but it is usually old honey, and often the accumulation of several years.

There are more bees in the woods than we perhaps have any idea of, especially in the neighborhood of considerable apiaries. In one of my first trials at bee-hunting I started a fine line, directly toward the woods, but I looked in vain for bees, after going into them, and finally gave it up. A few days afterward I got an old hand at the business to hunt them up for me, and he almost at once pointed out a tree plainly visible from where they were baited, standing in the open lot. As the tree contained very thick old honey, it had probably stood there unnoticed for years, and yet it was in plain sight. The same hunter very soon found another, but a little distance from this one. And within a few days we had found two more in that same locality.[36]

DOES BEE-HUNTING PAY?

If you can earn a dollar per day at some steady employment, I do not think it would, as a rule; but there are doubtless localities where an expert would make it pay well, in the fall of the year. With the facilities we now have for rearing bees, a bee-keeper would stock an apiary much quicker by rearing the bees than he would by bringing them home from the woods, and transferring. In the former case he would have nice straight combs, especially if he used foundation, but the combs from the woods would require a great amount of fussing with, and they would never be nearly as nice as those built on the foundation, even then. So much by way of discouragement. On the other hand, a ramble in the woods, such as bee-hunting furnishes, is one of the most healthful forms of recreation that I know of; and it gives one a chance to study, not only the habits of the bees, but the flowers as well; for in hunting for a bee to start with, we find many plants that are curious and many that we would not otherwise know they frequented. In some of our trips we were astonished to find the Simpson honey-plant, of which so much has been said in our back journals, growing in our own neighborhood, and we saw the bees drinking the sweet water out of the little hollow balls, or rather pitcher-shaped blossoms.

NEVER QUARREL ABOUT BEE-TREES.

When you have found your tree, go at once to the owner of the land, and get permission to take your bees. No matter what the law allows, do nothing in his absence you would not do if he were standing by, and do your work with as clear a conscience as you would work in your own bee-yard. Many quarrels and disagreements and much hard feeling have been engendered by cutting bee-trees. If I am correctly informed, bees are the property of whoever finds them first; and on this account it is customary to cut the initials of the finder, with the date, in the body of the tree; but you have no more right to cut the owner's timber without permission than you have to cut his corn I have never found any one inclined to withhold consent, when he was politely *asked* for permission to get our bees out of the trees. I do not wonder that people feel cross when their timber is mutilated by roving idlers, and I can scarcely blame them for giving a wholesome lesson now and then just to remind us that we have laws in our country for their protection. I hope my readers will have no disposition to trespass on the premises or rights of any one, without permission. The most difficult and particular person in your neighborhood will, in all probability, be found pleasant and accommodating, if you go to him in a pleasant and neighborly way.

BEE-KEEPING AS A SPECIALTY. See Buying Bees, also Biographical Sketches, in the back part of this work.

BEE-MOTH. When you hear a person complaining that the wax-worm killed his bees, you can set him down at once as knowing very little about bees; and if a hive is offered you that has an attachment or trap to catch or kill moths, you can set the vender down as a vagabond and swindler. You can scarcely plead ignorance for *him;* for a man who will take upon himself the responsibility of introducing hives, without knowing something of our modern books and bee-journals, should receive treatment sufficiently rough to send him home, or into some business he understands.

When a colony gets weakened so much that it can not cover and protect its combs, robbers and wax-worms help themselves as a natural consequence, but either rarely do any harm if there are plenty of bees, and a clean tight hive. If a hive is so made that there are crevices which will admit a worm, and not allow a bee to go after it, it may make some trouble in almost any colony; and I can not remember that I ever saw a patented moth-proof hive that was not

much worse in this respect than a plain simple box hive. A plain simple box is, in fact, all we want for a hive; but as we must have the combs removable, we must have frames to hold them; and if these frames are made so that bees can get all round and about them, we have done all we can to make a moth-proof hive.

Of course, colonies will at times get weakened; and with the best of care, with the common bees especially, worms will sometimes be found in the combs. Now if you have the simple hive I shall recommend, you can very quickly take out the combs, and with the point of your knife remove every web and worm, scrape off the debris, and assist the bees very much. If there is an accumulation of filth on the bottom-board, lift out all the combs, and brush it all off, and be sure you crush all the worms in this filth, for they will crawl right back into the hive, if carelessly thrown on the ground.

If you keep only Italians, or even all hybrids, you may go over a hundred colonies and not find a single trace of a wax-worm. At the very low price at which Italian queens are now to be purchased, it would seem that we are very soon to forget that a bee-moth ever existed;[37] and the readiest way I know of to get combs that are badly infested, free from worms, is to hang them, one at a time, in the center of a full hive of Italians. You will find all the webs and worms strewed around the entrance of the hive, in a couple of hours, and the comb cleaned up nicer than you could do it if you were to sit down all day to the task.

HOW TO KEEP EMPTY COMBS SECURE FROM THE WAX-WORMS.

If you have Italians only, you may have no trouble at all, without using any precaution; but if there are black bees around you, kept in the old-fashioned way, or in patent hives, you will be very apt to have trouble, unless you are careful. Suppose, for instance, you take a comb away from the bees during the summer months, and leave it in your honey-house several days; if the weather is warm, you may find it literally infested with small worms, and in a few days more the comb will be entirely destroyed. Combs partly filled with pollen seem to be the especial preference of these greedy, filthy-looking pests, and I have sometimes thought they would do but little harm, were it not for the pollen they find to feed on. A few years ago we used to have the same trouble with comb honey when taken from the hive during the early part of the season; but of late we have had less and less of it; and during late years I have scarcely seen a wax-worm in our comb honey at all, and we have not once fumigated our honey-house. I ascribe it to the increase of the Italians in our own apiary, and those all about us, for the greater part of the bees in the woods are now partly Italian. These have driven the moth before them to such an extent that they bid fair to soon become extinct. Perhaps much has been also done by keeping all bits of comb out of their way; no rubbish that would harbor them has been allowed to accumulate about the apiary; and as soon as any filth has been found containing them, it has been promptly burned. Those who take comb honey from hives of common bees are almost sure to find live worms in them, sooner or later.

How do the worms get into a box of honey that is pasted up tightly, just as soon as the bees are driven out? I presume they get in just as they get into the comb taken from a hive during warm weather. The moth has doubtless been all through the hive, for it can go where a bee can, and has laid the eggs in every comb, trusting to the young worms to evade the bees by some means after they are hatched. This explanation, I am well aware, seems rather unreasonable, but it is the only one I can give. In looking over hives of common bees, I have often seen moths dart like lightning from crevices, and have sometimes seen them dart among the bees and out again; but whether they can deposit an egg so quickly as this, I am unable to say. In taking combs from the hive containing queen-cells to be used in the lamp nursery, I have always had more or less trouble with these wax-worms. The high temperature, and absence of bees, are very favorable to their hatching and growth, and after about three days the worms are invariably found spinning their webs. If they are promptly picked out, for about a week, no more make their appearance, showing clearly that the eggs were deposited in the combs while in the hive.

When the queen-cells are nearly ready to hatch, I often hear the queens gnawing out, by holding the comb close to my ear. By the same means, I hear wax-worms eating out their galleries along the comb; and more than once I have mistaken them for queens. They are voracious eaters, and the "chanking" they make, when at full work, reminds one of a lot of hogs. As they are easily frightened, you must lift the combs with

great care, either to see or hear them at their work.

Their silken galleries are often constructed right through a comb of sealed brood, and they then make murderous work with the unhatched bees. Perhaps a single worm will mutilate a score of bees before it is dislodged. These are generally found at the entrance of the hive in the morning, and numerous letters have been received from beginners, asking why their bees should tear the unhatched brood out of the combs, and carry it out of the hives.* I presume the moth is at the bottom of all, or nearly all, of these complaints. If you examine the capped brood carefully, you will see light streaks across the combs where these silken galleries are; and a pin or a knife-point will quickly pry his wormship out of his retreat. As the young worms travel very rapidly, it is quite likely that the eggs may have been deposited on the frame or edges of the comb. It is a little more difficult to understand how they get into a honey-box with only a small opening, but I think it is done by the moth while on the hive.

You may, perhaps, have noticed that the moth-webs are usually seen from one comb to another, and they seldom do very much mischief unless there are two or more combs side by side. Well, if in putting away your surplus combs for winter you place them two inches or more apart, you will seldom have any trouble, even should you leave them undisturbed until the next July. There is no danger from worms, in any case, in the fall, winter, or spring, for the worms can not develop unless they have a summer temperature, although they will live a long time in a dormant state if not killed by severe freezing weather. I have kept combs in my barn two years or more; but they were not removed from the hives until fall, and were kept during the summer months in a close box, where no moth could possibly get at them. I have several times had worms get among them when I was so careless as to leave them exposed during warm weather, and one season I found nearly 1000 combs so badly infested that they would have been almost worthless in less than a week. The combs were all hung up in the honey-house, and then about a pound of brimstone was thrown on a shovel of coals in an old kettle. This was placed in the room, and all doors and windows carefully closed. Next morning I found most of the worms dead; but a few that were encased in heavy webs were still alive; after another and more severe fumigation, not a live one was to be found, and my combs were saved. I have several times since fumigated honey in boxes in the same way. The following extract from Burt's *Materia Medica* may contain some hints as valuable to apiarists as to doctors:

In the form of *sulphurous-acid fumes*, or gas, sulphur is the most powerful of all known agents as a disinfectant and deodorizer. To disinfect a room and clothing from infectious diseases, as smallpox, etc., first close up the chimney, and paste up all crevices of the windows and doors to prevent the escape of gas. Now raise up all carpets, and hang up the cloths, so that the fumes of gas may have complete access to them. When this is done, set a tub in the center of the room with six inches of water in it; in the center of this water place a stone that comes just above the water; on this stone set an iron vessel with two pounds of sulphur broken up into quite fine pieces or lumps; on this pour a few ounces of alcohol, to make the sulphur burn readily; set the alcohol on fire, and leave the room, closing the door behind you. It is well to repeat this fumigation three or four times.

After the bees have died in a hive, it should never be left exposed to robbers and moths, but should be carried indoors at once, or carefully closed up. If you have not bees either by artificial or natural swarming, to use the combs before warm weather you should keep a careful watch over them, for a great amount of mischief may be done in a very few days. I once removed some combs, heavy with honey, in August, and, thinking no worms would get into them so late, I delayed looking at them. A month later, the honey began to run out on the floor; and upon attempting to lift out a comb it was found impossible to do so. When all were lifted up at once, a mass of webs nearly as large as one's head was found, in place of the honey and combs. So much for not keeping a careful watch of such property.

But the practice in late years is to use bisulphide of carbon, the same drug that is spoken of under the head of ANTS. The combs to be treated are placed in a tight box or small room. A pint or a quart of the liquid, depending on the size of the inclosure, is then placed in an open vessel *above* the combs. As the stuff is very volatile it evaporates rapidly; and the fumes, being heavier than the air, settle down, passing around and all through the combs.

I have never tried the bisulphide myself; but those who have say it is much superior to sulphur. for combs that have been thoroughly fumigated with it (the sulphur) were found to be still infested with the pest. Sub-

* Brood that has been chilled in early spring or that has been overheated from any cause will be carried out in the same way.

sequent treatment with bisulphide as explained did the work, killing every thing in the way of worms and even eggs.

One should be very careful in handling this drug, and not inhale the fumes of it. A few breaths would probably cause no harm except a little dizziness. He should have every thing in readiness, pour out the liquid in the right place, and shut up the inclosure. On account of the fearfully explosive nature of bisulphide of carbon, it is advisable to use a large box or cupboard outdoors. One can. of course, use it in a building or room; but he should make sure there is no such thing as a fire, a lamp, or any thing that would ignite the explosive gas.

HOW TO KEEP EMPTY COMBS.

When combs are left in spring, after the death of the bees in a hive, there is no safer place to put them than in the care of a good strong colony. Brush off the dead bees and put the combs in a clean hive on the stand of a strong colony, and then place the colony *over* this hive of empty combs, so that they will be obliged to pass through the hive of combs to go in or out. In other words, give the bees no entrance, except that of the lower hive, allowing free communication between the two. The combs will be kept free from worms and mold, with no care whatever on your part, except to keep the entrance so small for two or three days at first that robbers shall not trouble.

After the weather has become warm, three or four stories of empty combs may be piled on the top of a hive containing a colony, with a queen-excluder between, and a frame of brood in the upper story to make sure that the bees traverse all the combs. [325]

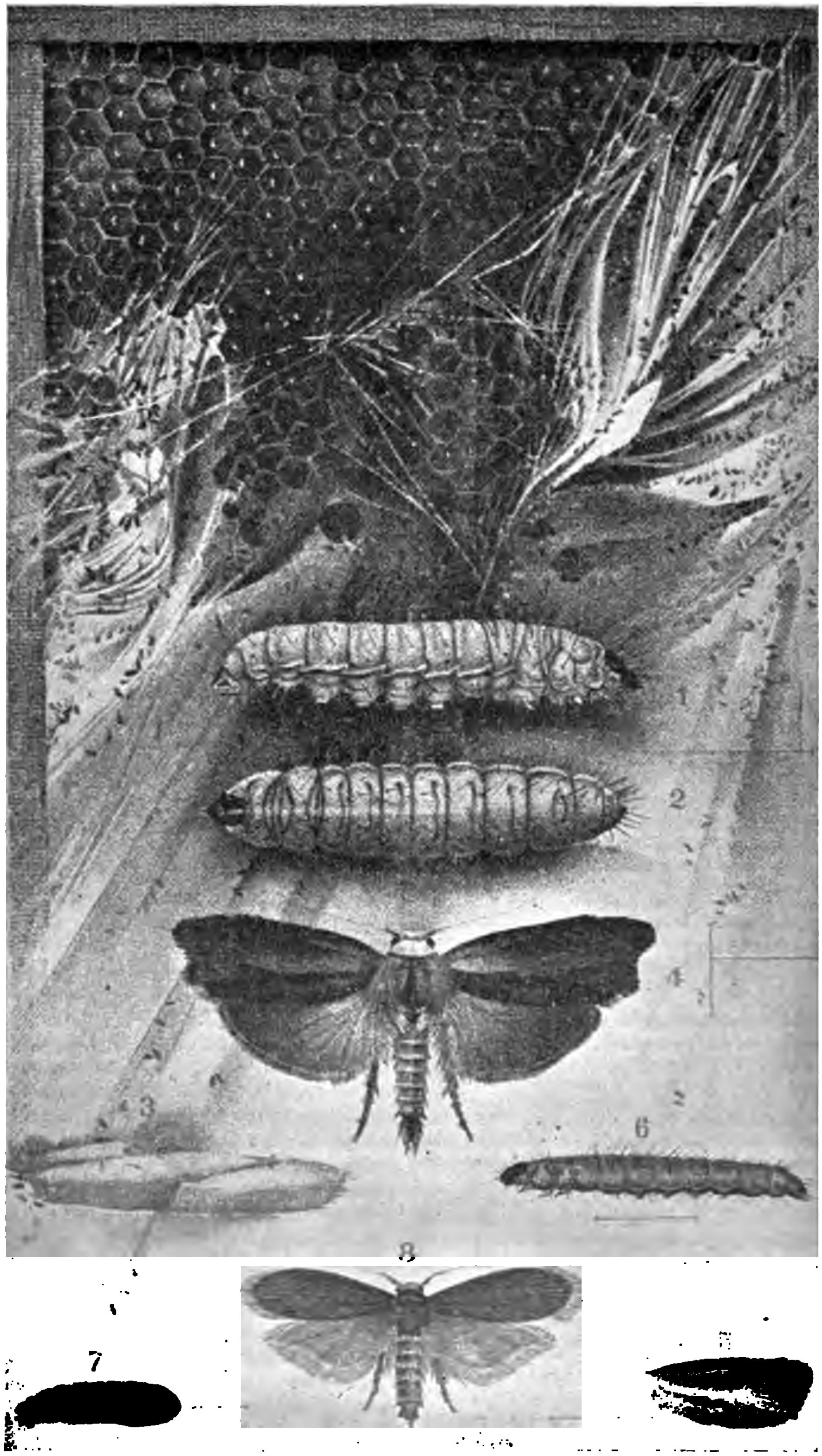
By way of summing up, I would say: Use plain, simple, inexpensive hives; get Italians as soon as you can; keep your colonies strong; be sure that none of them by any means becomes queenless, and you need have no solicitude in regard to the bee-moth among your bees. If you have spare combs, or comb honey that has been taken away from the bees in warm weather, keep an eye on it, and either destroy the worms as soon as they appear, or fumigate them as I have directed. When your eye has become trained, you will detect the very first appearance of a worm by its excrement, in the shape of a fine white powder. We sometimes hunt them out thus and destroy them, when they are so small as to be only just visible to the naked eye. Giving your combs a good freeze, say a temperature of 15 or 20°, will answer the same purpose as the fumigation. Then they must be kept in a tight box, or hives closed tight, to exclude moths, until wanted.

BEE-MOTH IN HIGH ALTITUDES.

In Colorado, or at least in the region of Denver, where the elevation is fully a mile above the level of the sea, the ordinary wax-moths are unknown. The great elevation seems to be more than they can stand. There is, however, a very small wax-worm, but it is not the same that ordinarily troubles bee-keepers.

The Government Entomologist for New South Wales, Australia, Mr. Sidney Olliff, wrote an article on the subject of bee-moth for the New South Wales *Agricultural Gazette*. There is so much of value in it, especially as it describes the same pest we have here, that I have decided to reproduce it in these columns. The illustration accompanying it is especially accurate.

The bee-moths, or beeswax moths, of which there are two distinct kinds commonly found in Australia, are so well known, and have been so frequently figured and described, that it will not be necessary to give very detailed or technical descriptions of them here. A considerable number of inquiries have been received during the past few years regarding these destructive moths, chiefly from amateur bee-keepers; and it may, therefore, be useful to publish a few notes concerning the habits and seasonal appearance of these insects in Australia, more especially as I am able to add some information regarding remedial and preventive measures for the suppression of the pests, which have been found satisfactory by experienced bee-keepers. The larger of the beeswax-moths—properly known as *Galleria mellonella*, Linn., but sometimes called by the name *Galleria cereana*, Fabr.—appears to be by far the more destructive of the two insects. It is a very widely distributed species, being found throughout Europe and North America, in India, and even in the cold regions of Northern Siberia; indeed, it appears to have a range that is co-extensive with that of the bee-hive itself. In warm countries it is much more abundant, and therefore destructive, than in temperate or cold climates, a fact which is probably accounted for by the varying number of broods or generations which occur in a season under different climatic conditions. With us in New South Wales the first brood of moth appears in the early spring from caterpillars which have passed the winter in a semi-dormant condition, within the walls of their silken coverings, and only turned to pupæ or chrysalids upon the approach of warm weather. These winter (or hibernating) caterpillars feed very little, and usually confine their wanderings to the silken channels which they have made for themselves before the cool weather sets in. Upon the return of the desired warmth the caterpillars spin a complete cocoon for themselves and turn to the chrysalis stage, and in from ten days to a fortnight the perfect moth appears. The moth then lay eggs in any convenient spot, such as the sides and bottoms of the frames, on the walls of the hive itself, or on the comb. In each case I have had an opportunity of observing the process, the moth chose the sides of the frames, as near to the brood-comb as possible, the young larvæ



BEESWAX MOTHS.

having a decided preference for this comb. The larvæ having once made their appearance, which they usually do in from eight to ten days after the laying of the eggs, their growth is exceedingly rapid, the average time before they are ready to assume the chrysalis stage being only some thirty days. The average duration of the chrysalis period is about a fortnight, so it can easily be seen with what great capabilities for rapid reproduction we have to deal. As we have said, the number of generations, or broods, which develop in a season, *i. e.*, between early spring and late autumn, varies with locality and climate, but it may be worth while to record that, in my opinion, we have sufficient evidence to prove the existence of four broods in the Sydney district under ordinary circumstances. I have myself bred three generations, or broods, from a comb received in early spring from the Richmond River; and I am convinced that a fourth might have been bred from the same stock but for an unfortunate accident to the eggs obtained from my third brood Upon first hatching, the larva is pale yellow in color, with a slightly darkened head; and, when full grown, it is of a dull grayish flesh color, with a dark reddish-brown head. Its average length is about an inch, and, like the majority of the caterpillars of moths, it has sixteen legs. The chrysalis of the larger beeswax-moth is of the ordinary type, and it is inclosed in a very compact cocoon of tough white silk, usually spun up in one of the silken channels or galleries made by the larva which we have previously referred to. The perfect insect, or moth, has reddish brown-gray forewings, which are distinctly lighter in color toward the outer or hinder margins. The sexes may readily be distinguished by the outline of the wings, as will readily be seen by a glance at the plate accompanying this article.

The second species of beeswax-moth is known as *Achræa grissella*, Fabr., the lesser beeswax-moth, or honey-moth, etc. Although not nearly so destructive as the larger kind, it does considerable damage in old and neglected hives. The moth is much smaller than *Galleria mellonella*, with which, by the way, I have found it associated in the same hive on more than one occasion. It is of a dead gray color, with a yellow head. This species is not nearly so particular in choosing its food as the former kind (*G. mellonella*), and may frequently be found feeding on the *debris* which commonly collects on the bottom of a neglected hive.

It is a well-known fact, that the beeswax moths do not attack the Italian (Ligurian) bee to any serious extent; indeed, they are rarely attacked at all. It is the ordinary black bee or hive-bee that suffers so greatly.

In conclusion I would express my thanks, among other kind correspondents, to Dr. Dagnell Clark, the Rev. John Ayling, and Messrs. Abram & Riddle, who have been kind enough to forward to the Department specimens or information.

So far as I am aware, very few recognizable figures of the bee-moths have been published, so that the plate attached, from the pencil of Mr. E. M. Grosse, will doubtless prove very acceptable. With the exception of an excellent wood cut in Dr. Taschenberg's "Die Insecten" (Brehm's Thierleben, Vol. IX., page 432) of the larger species, I have not been able to find a figure showing the stages or habits of these moths.

EXPLANATION OF PLATE.

BEESWAX-MOTHS.

Fig. 1.—Larva or caterpillar of Larger Beeswax-moth (*Galleria mellonella*, Linn.), side view (much enlarged).

Fig. 2.—The same viewed from above (much enlarged).

Fig. 3—Cocoon of same, extracted from bee-comb (enlarged).

Fig. 4.—Larger Beeswax-moth (*Galleria mellonella*, Linn.), male (much enlarged).

Fig. 5.—Forewing of same, female.

Fig. 6.—Larva or caterpillar of Lesser Beeswax-moth (*Achræa grissella*, Fabr.), side view (much enlarged).

Fig. 7.—Pupa or Chrysalis of same (much enlarged).

Fig. 8.—Lesser Beeswax-moth (*Achræa grissella*, Fabr.), (much enlarged).

In the background, above, a comb from a frame-hive is represented, showing brood-comb tunneled by the larvæ of the Larger Beeswax-moth (*Galleria mellonella*, Linn.).

The natural sizes of the insects are indicated by hair-line.

BEE PARALYSIS. See DISEASES OF BEES.

BEES. Throughout this work I deal particularly with the Italians and the common blacks of this country, and the crosses between the two, because they are used almost exclusively by bee-keepers. The crosses are often incorrectly denominated "hybrids;" but as that name has been generally adopted, we will use it. For particulars regarding these bees the reader is referred to HYBRIDS, which see. The Italians are spoken of specifically, also, under head of ITALIANS, elsewhere in this work.

BLACK OR GERMAN BEES.

As blacks are common in nearly every vicinity, very little description will be necessary. As the name indicates, they are black. One variety in the South is of a brownish black, and another is distinctly black, and is, if any thing, a trifle smaller.

Comparing the Germans with the Italians, they are more inclined to rob, are not as good workers, but are equal when nectar is abundant, or when there is dark honey like that from buckwheat to be gathered. They are much more nervous; and when a hive of them is opened they will run like a flock of sheep from one corner of the hive to another, boiling over in confusion, hanging in clusters from one corner of the frame as it is held up, and finally falling off in bunches to the ground, where they continue in their wild scramble in every direction, probably crawling up one's trousers-leg, if the opportunity is afforded. Their queens are much harder to find, their bees are not as gentle, and, worse than all, have a disagreeable fashion of following the apiarist about from hive to hive in a most tantalizing way. This habit of poising on the wing in a threatening manner before one's eyes is extremely annoying, as they will keep it up for a day

at a time unless killed. I generally make very short work of them by smashing them between the palms of my hands, or batting them to death with little paddles I keep handy by. It is useless to strike at individual bees while they are in the air, for one will be much more liable to miss them than to hit them. My practice is to take two sticks, one in each hand, and work them back and forth in front of my face very rapidly, just about as one would operate a fan on a hot day, but using two of them. This rapid movement excites the anger of the bees, with the result that they make a dive for the whirring of the stick; and in less time than it takes to tell it they get their heads rapped, and down they go one by one into the grass.

The comb honey of the blacks is a little whiter if any thing than that made by pure Italians, because the capping is raised up, leaving a slight air-gap between it and the surface of the honey in the cell. But the difference in the whiteness of capping is so very slight as compared with that made by the Italians that it really cuts no figure in the market. The blacks are also easier to shake off combs in extracting time, and for that reason alone some prefer them, or hybrids, to pure Italians, which can hardly be shaken off.

CARNIOLANS.

The Carniolans, evidently a variety of black bees, and which they very much resemble, were introduced into this country in 1884, or thereabouts. They are said to be very gentle; but the few colonies of them that we have tried are no more so than the average Italians, and in one case in particular they were more vindictive than the Cyprians. As stated, they resemble blacks, and might easily be mistaken for them; but there is a difference. They are larger, and their abdomens are more of a bluish cast, the fuzzy rings being very distinct. They are gentler, as a rule, and do not, like the blacks, boil over in confusion when the hive is opened, although one of our Carniolan colonies did this very thing. They have not the fixity of character of the Italians—colonies of the same race differing quite widely. The general verdict is, that they are excessive swarmers, and this trait alone makes them very undesirable. Their close resemblance to black bees makes it difficult to detect the crosses of the two races. This fact, coupled with their great swarming propensity, will largely prevent their meeting with general favor.[40]

But Carniolans have one good trait in their favor, and that is, that they deposit as little propolis as any bees ever known. Some colonies that we had, actually deposited almost none. In the production of comb honey this is quite an important item; but this trait seems to be almost entirely overbalanced in the minds of bee-keepers by the swarming propensity.

The Egyptians have been tried in our country to some extent, but are, I believe, inferior to the Italians, besides being much more vindictive. Bees from the island of Cyprus and from the Holy Land are mentioned in connection with ITALIAN BEES, which see.

ALBINOS.

Albinos are either "sports" from Italians, or, what is generally the case, a cross between Holy Lands and Italians; but after testing them in my own apiary, I find them little different from the common Italians. The fringe, or down, that appears on the rings of the abdomen of young bees is a trifle whiter than usual, but no one would observe it unless his attention were called to it. The queens are very yellow, but the workers, as honey-gatherers, are decidedly inferior, even to the second generation; and when we select light-colored bees or queens for several successive generations, if we are not careful we shall have a worker progeny lacking as honey-gatherers, and in ability to endure. By selection we can get almost any thing we want, and that quite speedily with bees, for we can produce several generations in a single season, if need be.

EASTERN RACES OF BEES.

Cyprians, Holy Lands, or Syrians, are mentioned later under the head of ITALIANS. Of the other Eastern races I can do no better than to quote what Prof. Frank Benton, Apicultural Expert of the U. S. Department of Agriculture, has to say of them in a special bulletin issued by the Department, entitled "Honey-bee," containing some 118 pages. Prof Benton spent some months in the jungles of India, in search of new bees. For this reason, if for no other, he is able to give us authoratative information. From the bulletin above spoken of, I make the following extracts:

THE COMMON EAST INDIAN HONEY-BEE.
(*Apis Indica*, Fab.)

The common bee of Southern Asia is kept in very limited numbers and with a small degree of profit in earthen jars and sections of hollow trees in portions of the British and Dutch East Indies. They are also found wild, and build when in this state in hollow trees and in rock-clefts. Their combs, composed

of hexagonal wax cells, are arranged parallel to each other like those of *A. mellifica*, but the worker brood-cells are smaller than those of our ordinary bees, showing 36 to the square inch of surface instead of 29; while the comb where worker-brood is reared, instead of having, like that of *A. mellifica*, a thickness of seven-eighths inch, is but five-eighths inch thick. (Fig. 1.)

The workers. — The bodies of these, three-eighths inch long when empty, measure about one-half inch when dilated with honey. The thorax is covered with brownish hair, and the shield or crescent between the wings is large and yellow. The abdomen is yellow underneath. Above it presents a ringed appearance, the anterior part of each segment being orange yellow, while the posterior part shows bands of brown of greater or less width, and covered with whitish-brown hairs; tip black. They are nimble on foot and on the wing, and active gatherers.

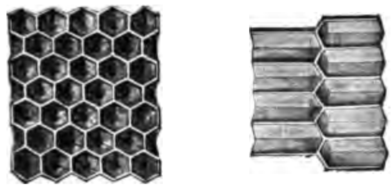


FIG. 1.— WORKER-CELLS OF COMMON EAST-INDIAN HONEY-BEE (APIS INDICA), NATURAL SIZE.

The queens.—The queens are large in proportion to their workers, and are quite prolific; color, leather or dark coppery. *The drones.*—These are only slightly larger than the workers; color, jet-like blue-black, with no yellow, their strong wings showing changing hues like those of wasps.

Manipulations with colonies of these bees are easy to perform if smoke be used; and, though they are more excitable than our common hive bees, this peculiarity does not lead them to sting more, but seems rather to proceed from fear. The sting is also less severe.

Under the rude methods thus far employed in the management of this bee no great yields of honey are obtained, some 10 or 12 pounds having been the most reported from a single hive. It is quite probable that, if imported into this country, it would do more. These bees would no doubt visit many small flowers not frequented by the hive bees we now have, and whose nectar is therefore wasted; but very likely they might not withstand the severe winters of the North unless furnished with such extra protection as would be afforded by quite warm cellars or special repositories.

Here is something exceedingly interesting regarding the smallest honey-bees in the world. Just take a look at the size of the cells as shown in the figure, natural size, and then compare them in your mind's eye with comb in your own apiary. Well, here is what he has to say:

THE TINY EAST-INDIAN HONEY-BEE.

(*Apis florea*, Fab.)

This bee, also a native of East India, is the smallest known species of the genus. It builds in the open air, attaching a single comb to a twig of a shrub, or small tree. This comb is only about the size of a man's hand, and is exceedingly delicate, there being on each side 100 worker-cells to the square inch of surface (Figs. 2 and 3). The workers, more slender than house-flies, though longer-bodied, are blue-black in

FIG. 2.—WORKER-CELLS OF TINY EAST-INDIAN HONEY-BEE (APIS FLOREA); NATURAL SIZE.

color, with the anterior third of the abdomen bright orange. Colonies of these bees accumulate so little surplus honey as to give no hope that their cultivation would be profitable.

GIANT BEES OF INDIA.

(*Apis dorsata*, Fab.)

A few years ago a great deal used to be said regarding the "giant," or East Indian, honey-bees, or *Apis dorsata*, and the possibilities of having them imported and domesticated in this country. Much of truth and nonsense has evidently been circulated in regard to them. Prof. Benton, having been right in their native land, gives us something here that can be relied on.

This large bee, which might not be inappropriately styled the Giant East-Indian bee, has its home in the far East—both on the continent of Asia and the adjacent islands. There are probably several varieties more or less marked, of this species, and very likely

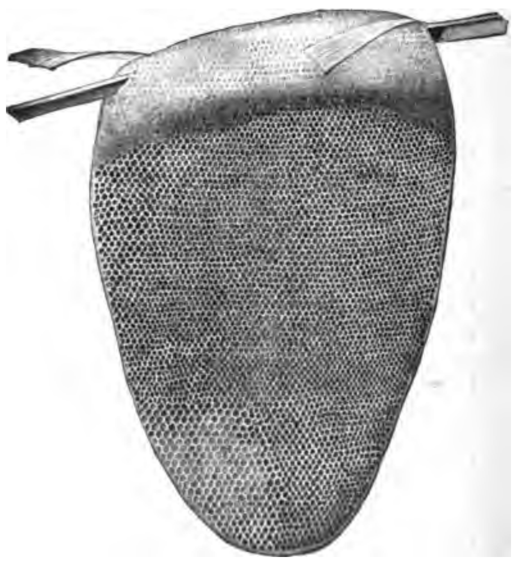


FIG. 3.—COMB OF TINY EAST-INDIAN HONEY-BEE (APIS FLOREA), ONE-THIRD NATURAL SIZE.

Apis zonata, Guer., of the Philippine Islands, reported to be even larger than *Apis dorsata*, will prove on further investigation to be only a variety of the latter. All the varieties of these bees build huge combs of very pure wax—often 5 to 6 feet in length and 3 to 4 feet in

width, which they attach to overhanging ledges of rocks or to large limbs of lofty trees in the primitive forests or jungles. When attached to limbs of trees they are built singly, and present much the same appearance as those of the tiny East Indian bee, shown in the accompanying figure (Fig. 3). The Giant bee, however, quite in contradistinction to the other species of apis mentioned here, does not construct larger cells in which to rear drones, these and the workers being produced in cells of the same size. Of these bees—long a sort of myth to the bee-keepers of America and Europe—strange stories have been told. It has been stated that they build their combs horizontally, after the manner of paper-making wasps; that they are so given to wandering as to make it impossible to keep them in hives, and that their ferocity renders them objects greatly to be dreaded. The first real information regarding these points was given by the author. He visited India in 1880-81 for the purpose of obtaining colonies of *Apis dorsata*. These were procured in the jungles, cutting the combs from their original attachments, and it was thus ascertained that (as might have been expected in the case of any species of apis), their combs are always built perpendicularly; also that colonies placed in frame hives and permitted to fly freely did not desert these habitations, and that, far from being ferocious, these colonies were easily handled by proper precautions, without even the use of smoke. It was also proved by the quantity of honey and wax present that they are good gatherers. The execution at that time of the plan of bringing these bees to the United States was prevented only by severe illness contracted in India.

These large bees would doubtless be able to get honey from flowers whose nectaries are located out of reach of ordinary bees, notably those of the red clover, now visited chiefly by bumble-bees, and which it is thought the East-Indian bees might pollinate and cause to produce seed more abundantly. Even if no further utilizable, they might prove an important factor in the production in the Southern States of large quantities of excellent beeswax, now such an expensive article.

There are a few in this country who believe the introduction of the giant bees here would result disastrously to the business; that, as the English sparrow has driven out some of our American song birds, so the *Apis dorsata* will drive out the Italians and black bees; that they will take the nectar that would otherwise go to *Apis mellifica*, and thus indirectly rob the bee-keeper. It is also stated that the *Apis dorsata* could not be domesticated, and that they would run wild all over the country; but from all the information I can gather I have no fears of any of these things. The facts prove that they have not run out *Apis Indica*, *Apis florea*, and other Eastern bees in their own habitats; furthermore, it is doubtful whether they would be able to stand our changing climate, even in the South, for it must be understood that India and the Philippines have a much warmer climate than our Southern States. That the giant bees will ultimately be brought here and tested, there can be no question; [327] but that they will ever prove to be of any commercial value or practical utility is doubtful. They are too large for the flora of this country; this very fact might render them of some little benefit in fertilizing certain flora that are vis-

NATIVE OF CEYLON CLIMBING A TREE FOR APIS DORSATA.

ited now by only the common bumble-bees; and it is the possibility of this that has much weight with those who are anxious to secure their introduction in this country.

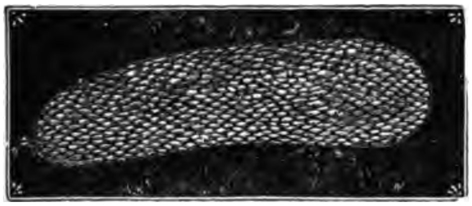
In subsequent editions of this book I hope we shall be in position to speak more definitely on all these points.

HOW BEES GROW.

Having devoted so much space to the different races of bees, it is now in order to discuss *how* they grow.

During warm weather, while your bees are gathering honey, open your hive in the middle of the day, and put in the center a frame containing a sheet of foundation; examine it every night, morning, and noon, until you see eggs in the cells. If you put it between two combs containing brood, you will very likely find eggs in the cells the next day.

If you have never seen an egg that is to produce a bee, you may have to look very sharp the first time, for they are white like polished ivory, and scarcely larger than one of the periods in this print. They will be seen in the center of the cell attached to the comb by one end. The egg under the microscope has much the appearance of the cut. It is covered, as you notice, with a sort of lace-like penciling, or net-work it might properly be called. As soon as you discover eggs,



A QUEEN'S EGG UNDER THE MICROSCOPE.

mark down the date. If the weather is favorable, these eggs will hatch out in about 3 days or a little more; and in place of the egg, you will, if you look sharp enough, see a tiny white worm or grub floating in a minute drop of milky fluid. If you watch the bees you will find them incessantly poking their heads into these cells, and it is likely that the milky fluid is placed on and about the egg a little before the inmate breaks its way out of the shell. I infer this, because I have never been able to get the eggs to hatch when taken away from the bees,* although I have carefully kept the temperature at the same point as in the hive. The net-work shown in the cut below will allow the milky fluid to penetrate the shell of the egg so as to furnish nourishment for the young bee at just the time it requires it. These worms are really the young bee in its larval state, and we shall in future call them larvæ. They thrive and grow very rapidly on their bread-and-milk diet, as you will see if you look at them often. They will more than double in size in a single half-day, and in the short space of 12 days they will have grown from a mere speck (the larva just hatched) to the size of a full-grown bee, or so as to fill the cell completely. This seems almost incredible, but there they are, right before your eyes. I presume it is owing to the highly concentrated nature of this same "bread-and-milk" food that the workers are so constantly giving them, that they grow so rapidly. If you take the comb away from the bees for a little while you will see the larvæ opening their mouths to be fed, like a nest of young birds, for all the world.

3 4 5 6 9 12 15

THE DAILY GROWTH OF LARVÆ.

The figures underneath represent the age in days from the laying of the egg. First is the larva just as it has broken the egg-shell on the third day; next, the larva on the fourth day. During the fifth and sixth days they grow very rapidly, but it is difficult to fix any precise mark in regard to the size. On the ninth day the larva has straightened itself out, and the worker-bees have capped it over. I have made a pretty accurate experiment on this point, and it was just six days and seven hours after the first egg hatched, when they got it completely capped over. [329] Just when they begin to have legs and eyes, I have not discovered; but I have found that the wings are about the last of the work.

In regard to this point. Frank Cheshire, in his work on "Bees and Bee-Keeping," says:

> The chorion of the egg breaks, usually after three days (the time varies according to temperature), and a footless larva, with thirteen segments, exclusive of the head, alternately straightens and bends its body to free itself of the envelope. It is extremely curious that, before hatching, the larva presents rudimentary legs, which disappear—a fact which some have supposed to indicate "atavism," a reference to an ancestral type in which the larva bore feet; but this does not seem to be valid, for reasons which would encroach too much on our space. Toward the end of the larval period, the three segments following the head have little scales beneath the skin on the ventral side, which are the beginnings of the legs, and which can not be seen until the creature has been immersed in alcohol: the budding wings outside these, on second and third segments, are, by the same treatment, brought under view, as are also the rudiments of the sting in queen or worker larvæ, the male organs appearing in that of the drone. After sealing, the fourth segment begins to contract, and the fifth becomes

* Since this was written it has been proven that eggs, removed from the hive, when subjected to proper temperature will hatch if supplied artificially with the milky food; otherwise, not.

partly atrophied, so that, soon, the former constitutes only a partial cover for the base of the developing thorax, and the petiole between it and the abdomen, while the latter becomes the narrow, first abdominal segment. It has been explained that the last three segments disappear in forming the sting; and now we find the fourth forming the petiole, leaving nine of the thirteen original segments, of which three go to the thorax, and six to the abdomen.

After the larvæ are 6 days old, or between 9 and 10 days from the time when the egg was laid, you will find the bees sealing up some of the largest. This sealing is done with a sort of paper-like substance; and while it shuts the young bee up, it still allows it a chance to breathe through the pores of the capping. It is given its last feed, and the nurses seem to say, "There! you have been fed enough; spin your cocoon, and take care of yourself."

After this, as a general thing, the young bee is left covered up until it gnaws off the capping, and comes out a perfect bee. This will be in about 21 days from the day the egg was laid, or it may be 20, if the weather is very favorable; therefore it is shut up 11 or 12 days. Now, there is an exception to this last statement, and it has caused not a little trouble and solicitude on the part of beginners. During very warm summer weather, the bees, for one reason or another, decide to let a part of their children go "bareheaded," and therefore we find, on opening a hive, whole patches of young bees looking like silent corpses with their white heads in tiers just about on a level with the comb. At this stage of growth they are motionless, of course, and so the young bee-keeper sends us a postal card, telling us the brood in his hives is all dead. Some have imagined that the extractor killed them, others that it was *foul brood;* and I often think, when reading these letters, of the family which moved from the city into the country; when their beans began to come up, they thought the poor things had made a mistake, by coming up wrong end first; so they pulled them all up, and replanted them with the bean part in the ground, leaving the proper roots sprawling up in the air. My friend, you can rest assured that the bees almost always know when it is safe to let the children's heads go uncovered. [331]

As it is, many times, very important to know just when a queen was lost, or when a colony swarmed, you should learn these data thoroughly; for instance, it will be safe to say, 3 days in the egg, 6 in the larva, and 12 days sealed up.

The capping of the worker-brood is nearly flat; that of the drones, raised or convex; so much so that we can at a glance tell when drones are reared in worker-cells, as is sometimes the case.

The young bee, when it gnaws its way out of the cell, commences to rub its nose, straighten out its feathers, and then to push its way among the busy throng, doubtless rejoicing that it, too, is one of that vast commonwealth. Nobody says a word to it, or, apparently, takes any notice of it; but for all that, they, as a whole, I am well convinced, feel encouraged, and rejoice in their way, at a house full of young folks. Keep a colony without young bees for a time, and you will see a new energy infused into all hands just as soon as young bees begin to gnaw out.

If you vary your experiment by putting a frame of Italian eggs into a colony of common bees, you will be better able to follow the young bee as it matures. The first day it does little but crawl round; but about the next day it will be found dipping greedily into the cells of unsealed honey, and so on for a week or more; after about the first day it will also begin to look after the wants of the unsealed larvæ, and will very soon assist in furnishing the milky food for them. While doing this, a large amount of pollen is used, and it is supposed that this larval food is pollen and honey, partially digested by the young or nursing bees. Bees of this age, or a little older, supply the royal jelly for the queen-cells, which is the same, I think, as the food given the very small larvæ.[42] Just before the larvæ for the worker-bees and drones are sealed up, they are fed on a coarser and less perfectly digested mixture of honey and pollen. The young bees will have a white downy look, until they are a full week old, and they have a peculiar look that shows them to be young until they are quite two weeks old. At about this latter age they are generally the active comb-builders of the hive. When they are a week or ten days old they will take their first flight out of doors, and I know of no prettier sight in the apiary than a host of young Italians taking their play-spell in the open air, in front of their hive; their antics and gambols remind one of a lot of young lambs at play.

It is also very interesting to see these little chaps when they bring their first load of pollen from the fields. If there are plenty of bees in the hive, of the proper age, they will not usually take up this work until about two weeks old. The first load of pol-

len is to a young bee just about what the first pair of pants is to a boy-baby. Instead of going straight into the hive with its load, as the veterans do, a vast amount of circling round the entrance must be done; and even after it has once alighted it takes wing again, rushes all through the hive, jostles the nurses, drones, and perhaps queen too, and says as plainly as could words, "Look here! This is I. I gathered this, all myself. Is it not nice?"

We might imagine some old veteran who has brought thousands of such loads, answering gruffly, "Well, suppose you did; what of it? You had better put it in a cell, and start off after more, instead of making all this row and wasting time, when there are so many mouths to feed." I said we might imagine this, for I have never been able to find any indication of any unkindness inside of a bee-hive. No one scolds or finds fault, and the children are never driven off to work, unless they wish. If they are improvident, and starvation comes, they all starve alike, and, as I do believe, without a single hard feeling or bit of censure toward any one. They all work together, just as your right hand assists your left; and if we would understand the economy of the bee-hive, it were well to bear this point in mind.

Shortly after the impulse for pollen-gathering, comes that for honey-gathering; and the bee is probably in its prime, as a worker, when it is a month old. At this age it can, like a man of 40, "turn its hand" to almost any of the duties of the hive; but if the hive is well supplied with workers of all ages, it would probably do most effective service in the fields. See AGE OF BEES.

If a colony is formed of young bees entirely, they will sometimes go out into the fields for pollen when but 5 or 6 days old. Also when a colony is formed wholly of adult bees, they will build comb, feed the larvæ, construct queen-cells, and do the work generally that is usually done by the younger bees, but it is probably better economy to have bees of all ages in the hive.

BEES ON SHARES. In some localities, notably in California, Colorado, and the great West, bees are often kept on shares. While this method of doing business has been conducted quite successfully and satisfactorily to both parties, yet nevertheless many disputes and troubles have arisen, perhaps because there was a lack of contract; or if there was one there was nothing in it covering the point in dispute; hence it may be well to specify some of the conditions under which bees may be kept on shares in a way that will be equitable to both parties concerned.

FORM OF AGREEMENT.

Articles of agreement made this ——— day of ———, 19—, between the party of the first part, ———, known as the owner of the bees, hives, and implements; and the party of the second part, ———, who is to perform all the necessary labor.

Witnesseth: That the party of the first part hereby covenants and agrees with the party of the second part to keep bees on shares, and to share equally in the honey and wax, under the following terms and conditions:

The party of the first part agrees to furnish all the bees, hives, implements, a location, and every thing necessary to carry on the business, except that he is to pay half the expense of the honey-packages, whether in the form of shipping-cases, sections, cans, bottles, packages—any and every thing designed to put the honey in marketable shape when it is harvested. All other materials and implements are to be provided at the expense of the party of the first part.

The party of the second part is to perform all necessary labor, and in consideration for such labor he is to receive half the honey crop and half the wax. The expense of sections, shipping-cases, or extracted-honey packages, for his share of the crop, is to be borne by himself.

All increase, swarms (artificial or natural), is to be the property of the party of the first part, who in every case is to furnish the necessary hives, hive-stands, covers, bottom-boards, and supers for such increase; but in no case is he to pay for more than his half of the cost of packages for the honey of such increase.

The party of the second part further agrees to remove the honey from the hives, and place the same in the marketing-packages, ready for delivery in the market.

Both parties agree to pay their proportionate share of the cartage to the nearest railroad station or market. At the close of the season the party of the second part is to see that all hives are doubled up or reasonably strong for winter; that they are well supplied with stores, and prepared for winter. If the colonies require to be fed, the party of the first part is to furnish the feeders and sugar necessary for making the syrup. Party of the second part is to make the syrup and feed it to the bees.

If, during the subsequent winter, the bees are lost, the party of the first part agrees to bear the loss unless he can show carelessness on the part of the party of the second part, in which case he may recover damages in an amount not exceeding half what it would cost to replace the bees and queens.

It is further agreed that, in case no honey is secured, or the amount runs below ten pounds per colony, the party of the first part is to pay the party of the second part an amount not exceeding $——— for the actual number of days spent on the bees.

Signature. ——— ———.
Signature. ——— ———.

Witness. ——— ———.
Witness. ——— ———.

The foregoing will make up the essential features of a contract; but local conditions

may render it necessary to make some modifications.

The last clause in the above contract is inserted as a matter of fairness to the party of the second part. If no honey should be secured, the party of the second part has performed his part of the contract in good faith, and, moreover, has improved the apiary—perhaps increased it—so that it will be in better condition the following year for a honey crop. For this betterment it is no more than right that the party of the first part should pay the party of the second part a reasonable sum, whatever amount may be agreed on; or, if preferred, a certain number of colonies. One can readily see that, in case the honey season was an absolute failure, the party of the second part would suffer a total loss except for a provision of this kind, and that the party of the first part would still have his bees, his implements, and every thing necessary to carry on the business for another season.

By the above contract it will be to the interest of both parties to keep down increase. The party of the second part will know, if he is a practical bee-keeper, that the greater the increase the less the honey; and he will, therefore, bend all his efforts and his skill to keep the colonies in the best possible condition to produce a crop of honey.

Keeping bees on shares is practiced quite extensively in Colorado and California. It very often happens that a bee-keeper lately from the East desires to try a locality to see whether it will be suited to his health, and whether or not he can make the keeping of bees a success. He accordingly finds some one who has bees, but who has other business, and desires some one competent to manage them for him. But where one is well settled in a locality, and has the means whereby he can purchase the bees, he had better do so—better even go into debt; but in this case, to secure the owner I would agree that, in case the honey crop is insufficient to pay for at least half the bees, he will then agree to content himself with half the honey crop on the terms above named.

BLEACHING COMB HONEY. See COMB HONEY.

BLACK BROOD. See FOUL BROOD.

BLUE THISTLE (*Echium vulgare*). If I am correct, this plant is not a thistle at all, but more properly a near relative of the borage, which it closely resembles. It grows in great profusion in many of the Southern and Middle States, but the principal reports seem to come from Virginia, and the valley of the Shenandoah. As it blossoms fully four months in the year, and produces a beautiful white honey, it would seem that it might well deserve a place among the plants on a honey-farm. If I am correct, it needs but little coaxing to cover whole farms; and in Virginia, we are told, there are large areas of it growing wild, as a weed. Over 200 lbs. of white box honey has been reported from it, from a single colony, in one summer. A field of blue is no doubt a very pretty sight to the bee-keeper; but to the farmers, who find it a great pest, it may not look so handsome. We have really no right to make our honey-farm a nuisance to the neighborhood, by bringing in foul weeds; so perhaps you had better take your bees down where it grows, instead of sending for seeds.

Later.—Recent reports indicate that it is no worse a weed than the borage. It dies root and branch every fall, and is therefore entirely unlike the dreaded Canada thistle.

BOX HIVES. It seems as if a description of a thing of this kind, in a work designed to teach modern apiculture, would be entirely out of place; but there may be many who have never seen any thing but a movable-frame hive; and as the old box hive is occasionally referreed to in various portions of this work, perhaps a brief description should be given.

These hives, as the name indicates, are merely boxes containing neither brood-frames nor any movable fixtures inside of the hive. They usually consisted of a rude rough box about a foot square, and from 18 to 24 inches high. Through the center there would be two cross sticks, the purpose of which was to help sustain the weight of the combs that were built in irregular sheets through the hive.

At the close of the season it was the custom for the apiarist to go around and "heft" his hives. Those that were heavy were marked to be brimstoned; and those that were light were left to winter over for next season if they could. The bees of the first named were destroyed with sulphur fumes, and then the bee-bread, honey, and every thing were cut out.

In the more modern box hives there were glass boxes that were drawn out from the upper part, leaving the lower part intact. In this case the bees were not destroyed. In any case there was no opportunity to inspect combs, hunt queens, divide, or perform any of the hundred and one operations of modern apiculture.

When one compares the crudity of these methods with those that are described in this book, he sees what wonderful progress has been make in apiculture.

BORAGE (*Borago Officinalis*). This has been at different times recommended for bees, but as those making the experiment of planting several acres of it did not repeat it in succeeding years, I think we are justified in concluding it did not pay. I have raised it in our garden, and some seasons the bees seem very busy on it. It has a small blue blossom, and grows so rapidly that a fine mass of bloom may be secured by simply planting the seeds on the ground where you dig your early potatoes. If it is to be raised by the acre, it should be sown at about the same time and much in the same manner as corn, in hills or broadcast.

In 1879 I had a half-acre of it. It was moderately covered with bees for many weeks, but was much inferior to the Simpson honey-plant.

BROOD. See BEES; also FOUL BROOD.

BROOD, SPREADING. See SPREADING BROOD.

BOTTLING HONEY. See EXTRACTED HONEY; also PEDDLING HONEY and CANDIED HONEY.

BUCKWHEAT. This, for certain sections of our country, is one of the most important honey plants It is grown principally on the hillsides of Eastern New York and Pennsylvania, and in these localities where are thousands of acres within a radius of a few miles, immense quantities of buckwheat honey are annually produced. On one hilltop in Schoharie Co., N. Y., near Gallupville, where I stood, I was told that within a radius of three miles the bees had access to 5000 acres of buckwheat, all of which was within the range of my eyes. So great is the acreage of it in New York that anywhere from 2000 to 3000 colonies can be kept in some counties; and this means hundreds of bee-keepers who are specialist honey growers and farmers, almost all of whom keep at least a few colonies. The latter class reason this way: That the growing of buckwheat as a grain is one of the most profitable branches of farming; that the nectar in the blossoms properly belongs to them, and if they keep a few colonies they will virtually get two crops from one field—honey and the buckwheat grain.

I have ridden on the bicycle over the buckwheat region of New York, traveling all day, and yet not getting out of sight of buckwheat fields that seemed to cover every available piece of ground on both sides of the road. So immense are the fields that the atmosphere seems to be heavily charged with the aroma of the bloom, and if one is not a lover of buckwheat honey the odor is somewhat sickening.

One bee keeper in the heart of the buckwheat country (W. L. Coggshall, of West Groton) who lives near Cayuga Lake, harvested one year with his 1000 colonies 78.000 lbs. of honey; another year 50,000 lbs.; and for a good many years his crops have ranged along into the carloads. While this is not all buckwheat honey by considerable, yet a good big portion of it is.

But the growing of buckwheat is by no means confined to the East. It is grown in small acreages, of say one to five acres, in most of the North Central States. It also is a paying crop for seed and honey in the South, being grown largely in South Carolina and Texas. But it is in Eastern New York, on the hillsides, that it seems to thrive best. Stalks of the celebrated Japanese variety that would measure two feet high in Ohio, will reach five or six feet in length in the more favored locations in New York. There is something in the climate and soil of those great hills that makes the growing of this plant much more profitable in the East than in the West, although it is always a paying crop for the grain in nearly every locality where ordinary grain crops can be grown.

THE QUALITY AND COLOR OF BUCKWHEAT HONEY.

Buckwheat honey itself is of a deep dark purplish tint, and looks very much like New Orleans or sorghum molasses. It is usually of heavy body; and the flavor, to one who is a lover of clover and basswood, and who has never been brought up on buckwheat honey, is more or less rank; and yet those who have always been used to buckwheat, or at least a good many of them, prefer it, even to clover or basswood.

A lady from the East once called at our store and looked over our honey. We showed her several samples of choice clover and basswood comb honey.

"I do not like this," she said. "It looks like manufactured sugar honey. Haven't you any buckwheat?"

"Yes, but we did not suppose you would like that, because such honey rarely sells in our locality."

We then placed before her some sections

of buckwheat honey, and these suited her exactly.

"*That* is real bee honey," said she, with a look of satisfaction, and she took with her several sections.

It seems that her father had been a bee-keeper, and about all the honey she ever saw was buckwheat; and unless it had the strong flavor and dark color of the honey she was familiar with in her girlhood days it was not honey to her, and there are thousands and thousands like her in the East.

Yes, there is a fancy trade that prefers buckwheat; and this trade is so large that buckwheat honey in the New York market brings almost as high a price as the fancy grades of white; but in the Western markets, principally in Chicago, "the stuff" goes begging a purchaser, and sells for an off grade or poor honey.

But notwithstanding the color of buckwheat honey itself is purplish, the cappings of the combs, especially if made by black bees, are almost pearly white. Buckwheat comb honey—some of it at least—is very pretty, and especially when it is put up by practical bee-keepers who know how to produce a first class grade of any honey.

IS BUCKWHEAT A RELIABLE SOURCE FOR HONEY, AND WHEN?

In the East, buckwheat can be depended on almost every year, for a crop of honey; but in the West it is rather uncertain—some years yielding no honey, and others doing fairly well. But when it does yield, the bees work on it almost entirely in the morning, the nectar supply lasting up till about ten or eleven o'clock. There are, however, exceptions.

In the East, if I am not mistaken, on account of the immense acreage, the bees are kept busy gathering honey from morning till night; and owing to the fact that it can be depended on almost absolutely for a yield of honey, whenever basswood or clover fails, as it does sometimes in any locality, the bee-keeper is able to pay at least expenses and something besides. Indeed, some years when there is almost a total failure of white honey the York State honey-producers are enabled to make a fair living from buckwheat alone.

DIFFERENT VARIETIES OF BUCKWHEAT.

The first buckwheat of which very much was known was designated as the black and the gray; later on, the silverhull came into prominence. Both of these varieties were finally displaced almost entirely by the celebrated Japanese. This variety was not only very much more prolific, but the kernels, or seeds, are very much larger—so much larger, indeed, that it necessitated the use of larger screens on the part of the millers who made a business of grinding it. At the present time the Japanese is grown almost exclusively. The accompanying illustration is a very excellent one of the buckwheat-plant in general; and while the kernels shown are a little larger than the natural size (engravings usually exaggerate), yet they are much larger than the old varieties of silverhull and gray.

The Japanese is an enormous yielder, and has been known to produce at the rate of 80 bushels per acre, and the crop has become so profitable in localities favoring its growth that it is not an uncommon thing for one farmer to raise anywhere from 500 to 1000 bushels.

BUCKWHEAT A PAYING FARM CROP.

I have set it down as a rule in this work that it is not profitable to grow any honey-plant unless the seed will pay the expense of the crop. In this case the buckwheat, as I have shown, is one of the most profitable grains that can be grown; and outside of any honey it may yield, there is "good money in it." In our own locality the yield of nectar from buckwheat is so irregular and so scant from season to season that we do not get very much of the honey; and yet when it does yield it affords an excellent diversion for the bees, keeping them out of mischief when there would be an absolute dearth of honey from every other source; but even in Ohio it pays to grow it.

HOW TO PREPARE THE SOIL FOR GROWING BUCKWHEAT, AND WHEN TO SOW.

Two crops of buckwheat *can* be grown in a season, but usually it does not pay. In such case it must be sown very early—so early that it is liable to be killed by the early frosts after it gets up. The extremely hot weather coming on while it is in bloom is not favorable to the maturing of the seed. Buckwheat ordinarily should be sown after some other crop, anywhere from July 1 to the middle of August, depending on the locality. Almost any soil can be used for growing it; but the better the soil, the larger the crop, of course. Some recommend a loose mellow ground, or a clover sod turned under. Others say plow immediately after sowing oats or planting corn. Buckwheat requires a great deal of moisture; and by working the soil *early* it becomes settled and holds the moisture; and the result is, the seed will fill better. After

plowing, the ground should be thoroughly harrowed, and then the seed may be sown with a drill. If a fertilizer is used, it should be put in at the same time with the seed and run through the drill. One experienced grower says that the sowing should be done while the ground is dry and dusty, and never immediately after a rain. After the sowing, the surface should be immediately rolled to compact the soil, as the grain sprouts quicker, and it is sometimes out of the ground in less than four days.

Mr. J. H. Kennedy, of Quenamo, Kan., tells us of a crop of 116 bushels of Japanese buckwheat that cost him next to nothing. After turning under his oat stubble in July, as it was too early to put in wheat he sowed the ground to buckwheat with a drill. This came off so soon that the ground was in almost as good condition, apparently, for sowing wheat as it was when first prepared. He then put the drill right on to the buckwheat stubble, and next season reported that the wheat sown on this stubble looked exactly as well as the rest sown on other ground. It is probable that a plant so different in its habit from wheat will take little if any of the necessary material for wheat from the soil; and it is a common remark that nothing fits the ground so nicely for a succeeding crop as buckwheat.

As to the amount of seed to the acre, it varies according to the locality. On good land two pecks per acre is recommended as enough; on thin soil, three pecks. One can increase the yield on thin soils by the use of

JAPANESE BUCKWHEAT.

50 lbs. of phosphate and 50 lbs. of plaster mixed and drilled in, according to W. L. Coggshall, of West Groton, N. Y., to whom I have already referred. The same authority estimates that buckwheat is one of the best crops to subdue rough land, and that it always leaves the ground in good condition for potatoes and oats, and almost any crop except corn.

Buckwheat as a fertilizer of soil is one of the best. Sometimes after late sowing, early frosts nip the stalks. In such cases I would always recommend plowing it under before the plants wilt. It will more than pay for its cost as a fertilizer, and some buckwheat-growers, I understand, enrich their soil every so often in this way, even if the frosts do not come in to spoil the crop. In this case they wait till after the blooming to get the honey and then plow under. Indeed, several prominent men recommend plowing in two and even three crops of buckwheat, one after another, when short of manure, and it is desired to get the ground into a high state of cultivation.

The best crop of buckwheat we ever had was from plowing under a crop of red clover. Under the influence of clover and abundant rains the grain matured in just 65 days after the sowing; and as the seed was not sown in the first place till after the 15th of August, our experiments showed that, under favorable circumstances, buckwheat is a very speedy crop. There was no killing frost that season until the last of October, but this, of course, is unusual.

SOWING BUCKWHEAT AND CRIMSON CLOVER AT THE SAME TIME.

During the last two or three years we have had excellent success in sowing crimson clover with buckwheat, especially where both were put in along the last of July or first of August. They come up together; but the buckwheat, being the stronger, takes the ground, and the crimson clover makes but little showing until after the buckwheat is harvested. Then the crimson clover, during the cool moist fall weather, rapidly covers the ground. If frost should kill the buckwheat, the crimson clover will rise up above it and hide its black unsightliness in a very brief period; and the dead buckwheat seems to be just the sort of mulching that the clover needs. The finest crop of crimson clover I ever grew or saw was put in in this way, and was turned under (June, 1900) for planting potatoes. Among bee-men, where the main thing is to get a crop of honey, a little turnip seed can be thoroughly mixed in with the clover seed. In this way at one sowing we have three honey-plants. Buckwheat gives a crop of honey in the fall; the turnips, if allowed to remain in the ground over winter, would blossom in the spring, almost the first plant to yield honey; and the clover will come into bloom shortly afterward, and so we may get a crop of grain, quite a crop of nice turnips, and clover to feed, to plow under, or a crop of clover seed next season. See Crimson Clover.

BUYING BEES. If one is an experienced bee-keeper, no advice need be given; but if he is a novice in the business, then I would strongly urge him to make a small beginning with as little expense as possible, for nothing is more discouraging, after having plunged into the business extensively, blindfolded as it were, than to lose a large portion of the bees either through wintering or from some other cause—all for the want of a little practical experience, or even a theoretical knowledge. Many a person has met with disaster from starting out with bees on too large a scale. Sometimes one is offered a bargain of 25 or 30 colonies including hives, bees, implements, smokers, etc., at a ridiculously low price, and the temptation is strong to buy. I would not advise the purchase unless the prospective buyer can get hold of some practical bee-keeper who can instruct him in the rudiments of bee-keeping. If he is an unusually bright, smart young fellow he might, and probably could, if he read this book carefully, be able to manage the whole apiary without previous experience, successfully.

My advice has always been to make a small beginning; and, after having invested $20.00 or $25.00, put no more into the business until the bees bring in some returns. In other words, *make the bees pay their way*. It is a very easy matter to "blow in a lot of good money" into the venture and get no returns, because bee-keeping as a business is something that depends more upon the weather than perhaps any other; and I do not, therefore, recommend any one to make bees his sole means of livelihood. True it is that there are many bee-keeping specialists; but they are men who have gradually grown into the business, and as a general rule have a specially favorable location, and keep anywhere from 500 to 1000 colonies.

The keeping of bees is generally more successfully carried on in connection with some other business. Many a professional man

desires some sort of light recreation, and a few bees will afford him just the diversion he needs. Farmers, fruit-growers, or horticulturists, can keep from 50 to 100 colonies without greatly interfering with any other work; and nearly every one, as explained under APIARY, can keep a few colonies in his back yard. Ten or twenty colonies will yield almost a certain return, a much larger revenue, per colony, than ten times that number.[333]

Having considered some of the difficulties and uncertainties of bee-keeping, one may now inquire whether he desires to go into the business at all. With the knowledge that from 10 to 20 colonies can usually be handled successfully, and at a good profit, the beginner will naturally desire to try his hand at it. How shall he make his start? If he can visit some practical bee-keeper for a day or two, he will be able to get hold of many of the "tricks of the trade." He will learn enough so that he can take up this work and read it and digest it in a way he could not otherwise; and I strongly urge any one, who can, to visit some bee-keeper—a practical man—and then buy of him one or two colonies. As to price, a strong colony of Italian bees, with tested queen, in a new Dovetailed hive, or in any modern hive, in fact, might be worth $10.00. This, ordinarily, would be considered the outside price. Ordinarily bees that are hybrids or black, in movable-frame hives, second hand, sell anywhere from $3.00 to $5.00 per stock, including hive. If there are no modern bee-keepers in the vicinity one may have to purchase a box hive or two with the combs all built solid into the hive—see BOX HIVES. The price of these, if they are blacks and hybrids, will be anywhere from $2.00 to $3.00 per hive. But the person who keeps bees in such hives will not be able to impart very much in the way of modern apiculture, and the only thing one can do in such a case will be to study this work carefully.

To move the black bees in box hives, turn the hive upside down, and tie over the end a piece of cheese-cloth. The moving should be done at night, or at least on a cool day. They should then be carried a distance of at least a mile and a half, otherwise many of the bees will return to their old location. See MOVING BEES.

In some localities it may not be possible to buy bees of any one. In such case send to the nearest dealer for a one or two frame nucleus. If one doesn't care for expense let him purchase four or five nuclei and then proceed to build them up as described under NUCLEI and FEEDING.[335]

But before purchasing any bees he should get of his dealer or manufacturer five or ten modern hives in the flat. As there are several such hives on the market, all of them fairly good, the beginner may be at a loss to know which of them to choose. All things considered, for most localities I would recommend the eight-frame Dovetailed hive, using Hoffman self-spacing frames.[337] See HIVES. These are sold by all the dealers, and as these hives are used largely by expert bee-keepers who carry on the business quite extensively with good results, the novice will not go far astray to adopt them.

As soon as the hives are received in the flat, nail them up and paint them, for with every lot of hives there will be sufficient nails of the right kind to put them together. If one can not afford to take the time himself, let him employ some carpenter, who, with the printed directions, will be able to put them together in a workmanlike manner.

Having the hives all in readiness, five or ten, as the case may be, one can, with his two or three nuclei, build them up by feeding, and then divide as recommended under NUCLEI and FEEDING.

If the beginner is successful thus far, he may then, with some assurance, purchase of his dealer one or two Italian queens, which he can easily introduce to the nuclei. See INTRODUCING. In dividing or forming nuclei, one should of course put the new queen he just purchased with the bees that are made queenless. After he has had a little more experience in watching and studying bees he may then be able to do something at queen-rearing. See QUEENS and QUEEN-REARING. To avoid trouble with robbers he should then read very carefully the subject of STINGS and ROBBING. Toward the close of the season he should then take up WINTERING, as found in its alphabetical order, reading this carefully; for more disasters in apiculture result from failure to winter bees properly than from any other cause.

Nuclei of one or two frames can be purchased of some of the dealers. These will be placed in light shipping-boxes, and will usually contain 500 to 1000 bees, one or two frames of brood, and a little honey. As the express charges on these bees will be double first-class, it is always cheaper and better to buy common bees in one's vicinity where possible, and, after transferring, introduce Italian queens.

C.

CAGES FOR QUEENS. See INTRODUCING.

CANDY FOR BEES. There is just one candy that is used universally by bee keepers. Though used particularly as a food in queen-cages and pound cages, it is also used for feeding during winter or early spring. It is none other than what is popularly termed the "Good" candy, after I. R. Good, of Nappanee, Ind., who introduced it in this country. It was, however, first invented by a German by the name of Scholz many years before Mr. Good introduced it. See "Langstroth on the Honey-Bee," p. 274, of 1875. By Europeans it is therefore called the Scholz candy.

HOW TO MAKE IT.

Make a stiff dough out of a first quality of extracted honey and powdered sugar. These are all the directions that were given at first, but it would seem that, from the difference in results, more specific directions are necessary. Mr. J. D. Fooshe (or, rather, his wife, who makes it for him) has been very successful in making candy. Their method is as follows: Take good thick honey and heat (not boil) it until it becomes very thin, and then stir in pulverized sugar.* After stirring in all the sugar the honey will absorb, take it out of the utensil in which it is mixed, and thoroughly knead it with the hands. The kneading makes it more pliable and soft, so it will absorb, or, rather, take up, more sugar. For summer use it should be worked, mixing in a little more sugar until the dough is so stiff as not to work readily, and it should then be allowed to stand for a day or two; and if then so soft as to run, a little more sugar should be kneaded in. A good deal will depend upon the season of the year. There should be more sugar in proportion to the honey in warm or hot weather, than for cool or cold weather. It should not be so hard in winter but that the bees can easily eat it, nor should it be so soft in summer as to run and daub the bees. For this reason the honey, before mixing, should be heated so as to be reduced to a thin liquid. For shipping bees, the main thing to look out for is to see that the candy does not run nor yet get hard. It is one of the nice points in making this candy to make it just right. Don't delude yourself by the idea that a second quality of honey will do. Always use the nicest you have. We have had the best results with first quality of clover extracted. Sage honey, for some reason or other, has the property of rendering the candy in time as hard as a brick, and, of course, should not be used.

With the Good candy we have been enabled, with the Benton cage, to send queens not only across the continent and to the islands of the sea, but even to Australia, on a journey of 37 days. There is not very much trouble in mailing queens to Australia, if the candy can be made just right so as not to become too hard nor too soft on the journey. If it retains a mealy, moist condition, the bees will be pretty sure to go through all right. See Benton cage, under INTRODUCING.

HARD CANDY FOR FEEDING.

There are some, perhaps, who would like to make the hard candy. The following are the directions we have used in the older editions of this work. The candy answers a very good purpose, but it is a good deal more trouble to make it, and it can be used only for winter and spring feeding.

HOW TO MAKE HARD CANDY.

Into a tin sauce-pan put some granulated sugar with a little water—a very little water will do. Make it boil, and stir it; and when it is done enough to "grain" when stirred in a saucer, take it quickly from the stove. While it is "cooking," do not let the fire touch the pan, but place the pan on the stove, and there will be no danger of its burning. Cover the dining-table with some newspapers, that you may have no troublesome daubs to clean up.

***Confectioners' sugar—a grade of pulverized sugar—will not answer, as it generally contains starch. While the latter is all right for frosting for cakes it is death to bees. Be sure the sugar is pure. If you can't get what you want, pound up granulated sugar with a mortar and pestle.**

To see when it is just right you can try dropping some on a saucer; and while you are at work, be sure to remember the little folks, who will doubtless take quite an interest in the proceedings, especially the baby. You can stir some until it is very white indeed for her; this will do very well for cream candy. We have formerly made our bee-candy hard and clear; but in this shape it is very apt to be sticky, unless we endanger having it burned, whereas if it is stirred we can have dry hard candy, of what would be only wax if cooled suddenly without the stirring. Besides we have much more moisture in the stirred sugar candy, and we want all the moisture we can possibly have, consistent with ease in handling.

If your candy is burned, no amount of boiling will make it hard, and your best way is to use it for cooking, or feeding the bees in summer weather. Burnt sugar is death to them, if fed in cold weather.

CANDIED HONEY. All liquid honey, and some comb honey, is liable to cloud and partially solidify at the approach of cold weather; that is, it assumes a granular mealy condition, something like moist Indian meal, and again like moist fine white granulated sugar. The granules of candied honey are about the size of grains of ordinary table salt, but may be much finer with some grades of honey. *Comb* honey granulates to a very limited extent, and after a much longer period, than extracted. While cold weather is much more conducive to granulation, yet in some localities, and with some honeys especially, it takes on the semi-solid form even in *warm* weather. Some honeys will candy in a month after being taken from the comb, and others will remain liquid for two years. The honey most liable to granulate is extracted alfalfa, as this does so in from three to five months. Mountain sage from California may remain liquid for a whole year, and sometimes longer; but in any case, no matter what the source, the thicker the honey—that is, the better ripened--the longer the period before it assumes the granular form. Ordinary comb honey in sections, if well ripened in the hives before it is taken off, will usually remain liquid for a year. After that time, especially if it has been subjected to cold during the previous winter, there are liable to be a few scattering granules in each cell. These gradually increase in number until the comb, honey, and wax may become almost one solid mass. In such condition it is fit neither for the market, the table, nor for feeding back, and should be treated by the plan I will describe presently.

IS GRANULATION A TEST OF PURITY?

In the eyes of the general public, granulated honey is not pure; some think it has been "sugared," either with brown or white sugar. But the very fact that it granulates solid is one of the best proofs of its purity. If honey granulates only partially, in streaks, it *may be* an evidence of the fact that it has been adulterated with glucose. But even pure honey will assume this condition; but a honey that is nearly two-thirds or three-quarters glucose will granulate but very little. But here, again, it must not be taken that it is positive evidence that, because the honey refuses to granulate, or only slightly so, therefore it is adulterated. The purity of any honey can usually be determined by the taste by an expert bee-keeper who has tested various grades of honey, and knows their general flavor. But here, again, even taste can not be considered an infallible test. Doubts can be removed only by referring a sample or samples to an expert chemist.

HOW TO PREVENT HONEY FROM CANDYING.

There is no plan that will act as an absolute preventive; but by a method which I will describe, granulation may be deferred for one and possibly two years. But even after treatment, if the honey is subjected to a freezing temperature for a series of days it will be almost sure to start candying again. After the first few days the honey will appear to be slightly cloudy. The cloudy appearance is more pronounced, and granulation proceeds more rapidly then, until the point of solidification is reached. But there is no excuse for having honey at any time, either comb or extracted, kept in a zero or freezing temperature; and for all practical purposes we can prevent honey from candying for a year on the average. The treatment, in a word, is simply to place the honey in a vat where its temperature can be raised gradually to the point of about 160 degrees Fahr., and maintained there until the honey is all liquid. It should not be allowed to become hotter, as that will have a tendency to darken the color and mar the flavor slightly. Indeed, it may be said that heating the honey to only 160° Fahr. has a tendency to change the flavor very slightly, but so little, indeed, that the average consumer will never detect it. If the two samples were placed side by side, it is doubtful whether he could tell which was which.

After the honey is sealed it should be kept in a room where the temperature does not go below 60° in winter. If it can be kept up to an ordinary living-room, all the better.

To liquefy honey in the candied state, or heat it to prevent its getting into that condition, the honey should be placed in a double boiler—that is to say, the tank should be double-walled, the space between the walls being filled with water. This may be placed on the stove and filled with honey. The double boiler used by the Rauchfuss brothers, of Denver, Col., is shown in the annexed engraving, and its manner of construction will be apparent.

But where one doesn't have such a boiler, and can not afford one, he can make a very good substitute by taking a common wash-boiler. Into this he is to place some blocks of wood about an inch square. On these blocks he is then to place three or four more tin pails, or as many as he can get into the boiler. If he has something larger than a wash-boiler it would be all the better. The honey is then poured into the tin pails. If it is candied solid it may be handled with a spade. Water is then poured into the wash-boiler so that it will come within two inches of the top of the pails. The whole may then be placed on the stove, and subjected to a slow heat. When the water reaches a temperature of 160, or nearly that, the fire should be checked; the honey should not become any hotter than the temperature named, as one may otherwise injure the flavor as well as the color. Honey should never be brought to a boiling temperature except to kill the germs of foul brood, and all such honey should be fed back provided it has boiled at least two hours. See FOUL BROOD.

DOUBLE BOILER FOR LIQUEFYING HONEY.

When the heated honey is brought to a clear liquid condition it may be placed in self-sealing glass jars or cans, and *sealed while hot*. If it is put into ordinary Muth jars, the corks should be dipped in paraffine or hot beeswax, or, better still, a mixture of paraffine and resin. After dipping they should be pushed into the bottles while the honey is still hot, after which the tops of the bottles and the corks may be paraffined and covered with tinfoil. The purpose of the waxing of the corks is to make them more impervious to the air. An authority on bottling says waxed corks are much better than plain ones for the prevention of granulation.

If Mason jars are used—something that is kept in almost every house for preserving fruit—no waxing of rubbers will be necessary; simply secure the covers *down tight with a wrench;* for the tighter the sealing, the longer will the honey keep liquid.

Honey that is brought to a temperature of 160° Fahr., and held at that point until it is perfectly clear, may be placed in self-sealing tin cans, square cans, or in any receptacle that permits air-tight sealing.

When this bottled honey is placed on the shelves of the dealer he should be shown the importance of having the temperature of the room kept as nearly uniform as possible, and under no circumstances to let it get down to freezing. The nearer he can keep the room at all times to 70° Fahr. the longer the honey will be kept liquid. If it clouds it should be taken off the shelves and replaced with other liquid honey. Under the head of EXTRACTED HONEY, full particulars will be given describing *how* to bottle honey and what packages to use.

In the great majority of markets, especially in the East, it is not advisable to put out honey in the candied form. It is very hard to convince consumers that it is not "sugared;" and if the honey is to be bottled, it should always be heated in the way stated, *and then sealed while hot* — mark that.

CAUSE OF GRANULATION.

As already stated, the primal cause is cold weather. But as some honeys differ chem

ically, it may be assumed that there is some other cause that operates to bring about the solid condition. Just what that is, we do not know; but we do know this, that stirring or violent agitation hastens granulation; and we also know that, if some granulated honey is mixed with ordinary liquid extracted, the latter will candy much more rapidly; for when honey *once starts* to granulate, the process goes on very rapidly, although it may take from one to two months even then for the honey to pass from the liquid condition to that of the semi-solid.

MARKETING CANDIED HONEY.

Although I have advised against this for most localities in the East, yet in some places in the West, where candying takes place very soon after the honey is taken from the comb, it has been found advisable to put the honey on the market in the granulated form. In such cases there should always be a label explaining how to liquefy the honey by placing the can in a vessel of hot water, and leaving it there until the honey turns back to the liquid condition. It is also necessary to explain that pure honey is almost sure to granulate solid like so much lard. Where the general public understands all this there is no trouble in disposing of the goods.

Mr. R. C. Aikin, of Loveland, Col., has made quite a specialty of selling his crop of extracted honey in large tin pails. Soon after it is taken from the combs it is drawn off into these pails, and allowed to stand until it becomes thoroughly candied. As these pails are not self-sealing they would leak if turned upside down; consequently the honey is not marketed until it is granulated hard. It may then be handled like so much lard, for indeed it is of about the same consistency. In the illustration will be seen Mr. Aikin's packages for candied extracted honey. He has sold his product in this way for a number of years, putting the price so low that consumers can afford to buy it in preference to other sweets which are less wholesome. His trade has come to like honey in this form, many of his customers preferring it for eating in that way, while others reliquefy before using. His manner of shipping is to pack these pails filled with candied honey in ordinary barrels. Straw is packed in around them: the barrels are headed up, and are then ready for any kind of journey, clear across the continent if need be.

CANDIED-HONEY CONFECTIONERY.

If we allow a barrel of linden or clover honey to become candied solid, and then scoop out the center after one of the heads is removed, we shall find, after several weeks, that the honey around the sides has drained much after the manner of loaf sugar, leaving the solid portion, sometimes, nearly as white as snow, and so dry that it may be done up in a paper like sugar. If we now take this dry candied honey and warm it in an oven until it is soft, it can be

AIKIN'S PAILS FOR CANDIED EXTRACTED HONEY.

worked like "taffy," and in this state we shall find it, perhaps, the most delicious confectionery we ever tasted. We can also make candy of honey by boiling, the same as molasses. See RECIPES OF HONEY AS FOOD.

FREAKS OF HONEY-CANDYING.

This problem of honey-candying is a very interesting one. It sometimes happens that of two lots taken from the same barrel or can, and placed in two self-sealing packages, that the honey in one will be candied

while in the other it will remain liquid, notwithstanding that both packages have been subjected to the same temperature and the same general conditions.[339] If this happened in the case of sealed packages only we might suppose that the sealing in one package was less perfect than in the other; but that the candying does not depend on the sealing altogether is shown by the fact that the two lots of honey may not be sealed, and yet one of them will turn to a solid while the other will remain liquid. But it should be stated that these instances are by no means frequent; indeed, they are rare; but they occur just often enough to excite our curiosity.

Another interesting fact is that, while honey may candy solid within six months from the time it is taken from the comb, yet if it is kept in the same cans and in the same condition for a period of two or three years a gradual change takes place, or at least has been known to do so. I have seen alfalfa honey after it had been in glass jars for seven years, and was told that it was candied solid within a few months after being taken from the extracting-cans. At the time I saw it (seven years after), it was going back to the liquid condition. Some cans were almost entirely liquid, and others had streaks of candied honey reaching out like the branches of an evergreen tree all through the package. These same jars are being watched with the expectation that the honey will ultimately turn back to the liquid. But there is no probability that it will taste the same as before it candied. Indeed, there is every evidence to show so far that it has undergone a slight chemical change. Whether that change is due to the continued effect of light upon the granules is not known.

THE SCIENCE OF GRANULATION.

While we do not know very much as yet about the theory of honey-candying, yet we do know this: That while the nectar of the flowers may be, chemically, cane sugar, yet after it has been stored in the hive by the bees, and digested or worked over as explained under HONEY elsewhere, it is known in science as invert sugar. Ordinary honey is a solution of dextrose, levulose, and water, of approximately equal proportions. "Honey candies upon standing," says Dr. Headden, of the Colorado Experiment Station at Fort Collins, "because of the ability of the dextrose to assume a crystalline form much more readily than the levulose." At the Colorado State bee-keepers' convention, he showed us samples of free dextrose and of levulose. The former looked like a very nice light-colored brown sugar; the latter appeared like a cheap grade of dark-colored molasses. The doctor went on to explain that, if candied honey were subjected to a sufficient pressure, the greater portion of the levulose could be obtained, leaving the solid mass largely dextrose. While the levulose of the honey candies slightly, yet it is very different in appearance from the dextrose portion of it.

HOW TO GET CANDIED HONEY OUT OF BROOD-COMBS AND YET SAVE BOTH THE COMB AND THE HONEY.

Honey, if candied at all in brood-combs, will usually be only partially so. After uncapping, M. M. Baldridge, of St. Charles, Ill., recommends placing all such combs in the extractor, and throwing out any of the liquid portion of the honey then remaining. He next lays the combs in the bottom of a clean wash-boiler, and, with a dipper of water elevated, pours the water slowly into the cells. He then turns the comb over and treats the other side the same way. As fast as the combs are splashed with water he places them in a hive or super. When they have all been doused he takes them out and sets them over strong colonies. The bees, by the aid of the water, will liquefy the whole mass, he says, clean the combs out, and save both the combs and honey.

Comb honey in sections that is candied can scarcely be treated in this way, as it would be impracticable to uncap the cells. These had better be placed in a solar extractor (see WAX), and allowed to remain there until the sun melts out both comb and honey. The wax will, of course, rise to the top in the receiving-pans, and the honey will settle to the bottom. The former will be first grade, while the latter can be used only for feeding back for brood-rearing, because both color and flavor will be a little "off."

CARNIOLANS—see BEES.

CATNIP. (*Nepeta Cataria*). This is a near relative of GILL-OVER-THE-GROUND, which see. Quinby has said, that if he were to grow any plant exclusively for the honey it produced, that plant would be catnip; and very likely he was not far from right. But as we have never yet had any definite report from a sufficient field of it to test it alone, either in quality or quantity of the honey, we remain almost as much in the dark in regard to it as we were at the time he made the statement, many years ago

Several have cultivated it in small patches, and have reported that in a state of cultivation it apparently yielded more honey than in its wild state, for bees are found on it almost constantly, for several months in the year; yet no one, I believe, is prepared to say positively that it would pay to cultivate it for this purpose.

CLIPPING QUEENS. See QUEENS.

CLOVER (*Trifolium*). I think we may safely say this is by all odds the most important honey-plant on the North American continent, and I do not know but of the world. So important is it that, when it fails to yield nectar generally, there is a failure of the honey crop throughout the country. The plant is made thus important because of its general distribution over the continent. It is scattered over Southern Canada, Eastern and Northern United States, and even finds its way into our Southern States. Should some insect pest within a year or so destroy all the clover in the United States, the bee business for over half of the localities in the country would be practically ruined, and one of the finest honeys (and by many considered the best) would for ever be banished from the markets. This would mean that the annual crop of all honey, including that not marketed but consumed at home, for the United States alone would be cut down perhaps 50 per cent.

While some persons seem to tire in time of almost any one kind of honey, that from clover seems to wear like bread and butter, for it is a great staple in the markets; and where one can recommend his honey as being entirely from white clover he has said about all he can for it.

If we look over the markets we find that such honey is generally listed at the highest price. There may be other honeys that are quite as good, if not a little better, in flavor; but its general *reputation* is such that the public throughout the country, when it wants the best, calls for white clover.

Years ago, white clover was regarded as an unfailing supply for nectar; but within the last ten or fifteen years, for causes for which we can assign no reason, our great standby honey-plant has come to be somewhat irregular. While it may grow profusely, and while it may blossom, and all the conditions seem favorable for the secretion of nectar, yet it will occasionally fail absolutely to give up its sweetness; and, worst of all, there may be three or four seasons running when there is but very little honey from it. Then it is the bee-keeper sees real "hard times," especially if he has his all invested in the business.

The reduction in the amount of clover is partly explained by the fact that the waste lands and pastures, formerly so thickly covered with the plant, have given place to intensive agriculture. This is especially true near the large centers of population where every foot of land must be turned to account to pay taxes. But even making a liberal allowance for all this there are some conditions that have operated to prevent the secretion of nectar from clover some seasons.

VARIETIES OF CLOVER.

The most important is the common white clover (*Trifolium repens*), which everybody knows. We could better spare any of the rest, and I might almost say all the rest,

WHITE CLOVER.

than our white clover that grows so plentifully as to be almost unnoticed nearly everywhere. But little effort has been made to raise it from the seed, because of the difficulty of collecting and saving it.

There is a large variety known as white Dutch clover, that is sold by our seedsmen, to some extent. I have not been able to gather whether it is superior to the common.[341] The common red clover—*T. pratense*—yields honey largely some seasons, but not as generally as does the white, nor do the bees work on it for as long a period.[49] While working on red clover, the bees bring in small loads of a peculiar dark-green pollen; and by observing this we can usually tell when they are bringing in red-clover honey. The Italians will often do finely on red clover, while the common black bees will not even so much as notice it. The cultivation is much like that of alsike, mentioned further on: but the safest way for a beginner is to consult some good farmer in his own neighborhood, as different localities require slightly different treatment. The same will apply to saving the seed, which can hardly be saved profitably with-

out the use of a clover-huller made especially for the purpose.

PEAVINE, OR MAMMOTH RED CLOVER.

This is the largest kind of red clover known, as its name indicates; and it does, many seasons, furnish a very large amount of honey. As a rule, however, like the red clover mentioned above, it is seldom worked on by the common bees; but nearly every season it is visited more or less by Italians; and some seasons, where large fields are near by, the bees store very large amounts of very fine honey from this source alone. As it is in bloom principally during the months of August and September, it is a very important honey-plant.[50] Although the hay is hardly equal to that from the common red clover, it is perhaps the best forage plant to plow under, known. When well started it will grow on almost any soil; and once a good stand is secured and plowed under, the ground will be in condition to furnish a fair crop of almost any thing.

ALSIKE CLOVER.

This was formerly supposed to be a hybrid, since in appearance it is so nearly intermediate between the white and red clover; hence its name, *Trifolium hybridum*, Linn. It is now known that it is a distinct species. While it yields fully as much honey as the red, the petals are so short that the bees find no difficulty in reaching it. If you imagine a large head of white clover, with the extremities of the petals tipped with a beautiful pink—equal in beauty to a dahlia if they were not so common—you will have a very good idea of the alsike.[343] The leaf is much like that of other clovers, except that, in color, it is a soft clean bright green, without the spots of down that are seen on the white or red.

If alsike clover came into bloom at a season when bees could get little else, as buckwheat does, I should place it, instead of buckwheat, first on the list of plants for artificial pasturage.* Where white clover does not grow spontaneously, alsike is, undoubtedly, ahead of every thing else now known. It not only produces honey in large quantities, but the quality is not excelled by anything known in the world.[17] It is true, many people will prefer basswood, mountain sage, and other aromatic flavors, at first taste, but I believe every one tires of these after a time, and clover stands almost alone, as the great staple for every-day use, with and like our "bread and butter."[345]

CULTIVATION, AND SOWING THE SEED.

The cultivation is so much like that of red clover, that what applies to the one will do for the other. As the seed of the alsike is much smaller, a less quantity is required; the general rule is four pounds to the acre. As it blossoms only the second year, or very sparingly the first, with ordinary cultivation it may be sown almost any time, and in fact it is often sown on wheat on the snow in March. In this way we can see just how evenly we are getting it on the ground. The farmers near me who furnish the finest seed say they have the best success with that sown with their oats in the spring. Although alsike will produce some honey with almost any cultivation, it is important to have the ground nicely prepared, if we wish to get large yields of either hay or honey. With good mellow ground, finely pulverized, we may get a growth of 3 feet in height, and a profusion of highly colored blossoms that will astonish one who has never seen such a sight; especially when the field is roaring with the hum of the busy Italians. As a heavy growth is liable to lodge badly during wet weather, it may be well to sow a sprinkling of timothy seed with it. If put in early, it may on good soil produce considerable bloom the first season, but not much is to be expected until the second year, when it is at its height. It will give a fair crop the third year; but after that, if we would keep up a yield of honey it must be sown again.[18] It may be sown in the spring on fall wheat; but where timothy has been sown with the wheat in the fall, it is apt, on some soils, to choke out the alsike.

*If alsike is cut, or even pastured off, just before coming into bloom, it will blossom again, just after white clover is gone, and give a crop of clover honey just when we most need it. One of our leading honey-men says this fact alone, learned at a convention, has been worth more than $50.00 to him.

SAVING THE HAY.

If raised for the hay and honey, without any reference to saving the seed, it will give at least two good crops every season; in this case, it is cut when in full bloom. In our locality it usually blooms the last of June, and sometimes furnishes considerable honey before the white clover is out. The hay is admitted by all to be equal to any of the grasses or clovers in use,[347] and the pasturage, after the clover is cut, is most excellent for all kinds of stock.

Its value for milch cows is shown by the following, taken from *Gleanings in Bee Culture*, Vol. XIII., page 161:

AS A FORAGE-PLANT

it has no superior, producing a large flow of very rich milk. June 15th, when I shut the stock out of the alsike, I allowed them to run in a field of red clover that was just coming into blossom, and at the end of the third day the five cows had shrunk their milk to the amount of 9 quarts to the milking. Then, in October, to test it further for feed, as there was quite a growth of leaves on the ground I again allowed the cows in the field. You may judge of my surprise when I found, at the end of a week, they had made a gain of 10 quarts to the milking.

Millington, Mich. M. D. YORK.

SAVING THE SEED.

The seed is always saved from the first crop of blossoms, and it should be allowed to stand about two weeks longer than when cut for hay. If you wish to get a good price for your seed, it must be very nicely cleaned. It is thrashed out with a clover-huller, made expressly for clover seed, and then cleaned with a fanning-mill, with the appropriate sieves. As timothy seed is very nearly of the same size, it is difficult to remove it all, unless by a fanning-mill having the proper blast arrangement. As the alsike weighs 60 lbs. to the bushel, and timothy only 45, there is no great difficulty in doing it effectually.

I need scarcely add, that whoever raises seed for sale should exercise the most scrupulous care to avoid sending out foul seeds of any kind; and where Canada thistles or weeds of that class prevail, I would, under no circumstances, think of raising seed to be sent all over the land. If they are in your neighborhood, raise hay and honey, and let seed be furnished by some one who is differently situated.

PROFIT OF THE CROP.

The seed has for a number of years sold for from $5.50 to $8.00 per bushel, and the average yield of seed is about four bushels per acre. It retails for 15 to 18 cents per pound, and 60 lbs. is reckoned as a bushel. See CLOVER.

The following, taken from *The Farmer*, of St. Paul, Minn., not only shows what profit may be realized in raising alsike, but is another proof of its value as a hay crop. The reader will observe that the writer is in no way interested in bees.

WILL IT PAY FARMERS TO RAISE ALSIKE WITHOUT ANY REFERENCE TO BEE-KEEPING AT ALL?

About 20 years ago I bought my first alsike clover seed, and sowed it alone on the south side of a hill. The season was dry, and it grew only about a foot high; and as it was said the first crop produced the seed, I cut it for seed and felt disappointed at getting so little that I was ready to pronounce it a humbug, and plowed it up the same fall. Some years afterward I saw a bushel of seed at the Dane County Fair, at Madison. I inquired of the owner, Mr. Woodward, how he liked it, and if it was a profitable crop. He said he got four bushels of seed per acre, and sold it at $10 per bushel; that the hay, after being hulled, was better than the best red-clover hay, and that his cattle ate it in preference to any other hay. I bought two bushels of the seed and sowed about one bushel to twelve acres, mixing one-third timothy, by measure, where I wanted it for pasture or hay, and about the same quantity of pure alsike where I wanted it for seed. It does not raise seed the same year it is sown, but, like red clover, the next year. I have sown it with wheat, barley, and oats. It does best with spring wheat or barley.

I hulled 110 bushels this year from 20 acres. I expect to get $7.00 per bushel, and I have at least 25 tons of good hay, after hulling, worth enough to pay all expenses of cutting and hulling. Some years ago I sold my whole crop on the Board of Trade in Chicago for $11.00 per bushel.

Mr. George Harding, of Waukesha, a breeder of Cotswold sheep and short-horn cattle, and one of Wisconsin's most wide-awake farmers, showed me a small field of one of his neighbors that he said produced seven bushels of alsike seed per acre, and that he sold it in Milwaukee for $12.00 per bushel. I have 80 acres in alsike; and so long as it pays me as well as it has done, I will sow it.

The first crop the next year after sowing is the seed crop. It can be cut for seed for several years. It is not a biennial plant like red clover, but a perennial. It has one tap root with many branches, and does not heave up by frost, like red clover, which has but one tap root.

I prefer it to red clover for several reasons. When sown with timothy it matures with timothy. (Medium red clover matures before timothy is fit to cut.) I cut about the 10th to 15th of July; red clover should be cut (here) about the 20th of June. Alsike is not easily injured by dew or light rains after being cut. It has none of the "fuzz" that red clover has, making it so unpleasant to handle as hay or seed. The stem is not so coarse nor so hollow, and has more branches, leaves, and blossoms. The blossom is of a pink color. Red clover must be cut when we are in the busiest time working our corn. Alsike is cut after corn work is over. This is of great advantage in a corn region.

Alsike makes a good fall pasture after the seed is cut. My stock will eat it in preference to red clover, timothy, or blue grass. Blue grass, or, as it is often called in this country, June grass, is a good early and late grass, but in midsummer is

dries up; and had it not been for clover we should have been badly off for pasture this dry year.

Dane Co., Wis. (HON.) MATT. ANDERSON.

The next, from *Gleanings in Bee Culture*, Vol. XIV., page 327, is of so much importance in regard to raising alsike or other honey-yielding plants, that we give it here entire :

A SUGGESTION TO BEE-KEEPERS IN REGARD TO HAVING ALSIKE RAISED BY THE FARMERS OF THEIR OWN NEIGHBORHOOD.

I have managed to supplement the natural supply for my bees during the last five or six years as follows: I first tried sweet clover with but poor success, so I took up alsike clover, and this is the way I work:

About this time of the year I buy from 200 to 400 lbs. of best alsike clover seed in Montreal at wholesale price. This year I can get it for 12 cts., perhaps less. I expect to buy my supply next week. It will cost me ½ ct. freight, and I shall probably sell it to the farmers who are *within two miles of my apiary*, for 10 cts. per lb. At this price it is readily taken up by all who are "seeding down" land suitable for alsike, as the price in the stores here is from 16 to 18 cts. Three pounds mixed with timothy will seed an acre very well, so you see I get pasturage which will last from two to five years, of the very best quality of honey, at the small cost of $7.50 for one hundred acres. I can not conceive of any plan which, with me, would be cheaper, less trouble, or that would give as quick and reliable returns. I could get a good deal of seed sown by selling it at cost; but I find that taking off two or three cents per pound makes a great difference in the amount sown. As white and alsike clover are the most reliable honey-plants we have here – very rarely failing entirely—the results have been very marked and satisfactory.

To those who wish to try this plan I would say, Work up the matter personally; canvass every farmer within two miles and more in every direction from your apiary (those living more than two miles should pay cost of seed), showing them a sample of your seed, pointing out its advantages, etc. Although alsike-clover hay will not weigh so heavy as red clover, it is far sweeter and better, and all stock far prefer it to eat. One pound of seed, also, will go as far as two pounds of red clover, as the seeds are so much smaller.

Canvassing the farmers should be done *at once*, as every good farmer plans his work and buys his seed early. After you have finished canvassing, add up your orders, send to a reliable seedsman, distribute, and get pay for your seed, and your work for the season is done; but it should be repeated every season, to enlarge your "base of supply" as much as possible. Of course, you will have to wait one season before the alsike will bloom.

In localities where different apiaries are near together, if the seed is furnished under cost the parties should make up the amount of the difference *pro rata*, according to the number of colonies they have.

A WORD OF CAUTION ABOUT SOWING ALSIKE.

First, get the *very best* seed you can find. Poor seed is an abomination. Don't sow it on dry, sandy land, for alsike delights in a moist soil.

This simple plan of increasing pasturage may not be new, but I never heard it mentioned, though doubtless some have tried it.

Danville, Quebec, Can. GEO. O. GOODHUE.

We need hardly add, that the above plan can be carried out with buckwheat, rape, and any other honey-yielding plants that are of value to farmers.

SWEET CLOVER.

Within the last few years this plant, commonly denominated a weed by town councils and by ignorant farmers, is finding its way over the entire United States. I can remember a few years ago, when a plant of sweet clover was unknown around here. The first few plants that I ever saw created quite a sensation, both on the part of the bee-keeper and of the general public; because, during the time they were in bloom, they were fairly covered with bees. So far from being a noxious weed it is really a valuable forage-plant in some localities;[349] and while the white clover, for some unaccountable reason, is not yielding as it did some years ago, *sweet* clover, a wonderful honey-plant, seems determined to make up for the loss by spreading itself from one end of the country to the other. It takes special delight in growing on waste places, even on the hardest and roughest clay, along common wagon-roads and railroads. It is scattered over the former by being carried on the wheels of the wagons when the roads are muddy, and as a consequence the plants may be found along most of the highways of the country. Over the steam roads the rapidly moving trains, by reason of the great suction generated, gather up the seeds and drop them along their journey, with the result that the seed is scattered by the cars from one end of the country to the other: but it never occupies the good arable fields of the farmer, for it is very easily exterminated. From the very fact that it will grow in waste places where nothing else would eke out a living, we may say that it is really adding to the wealth of the country. In some localities it affords the only forage-plant that will grow, and as such is very valuable. In other localities where it grows by the roadsides and along railway tracks, it furnishes a little honey to the bees during that time of the year when no nectar can be obtained from any other source; and if it were grown in great patches instead of in streaks a mile or a hundred miles long it might be much more important as a honey-plant; but as bees will not ordinarily fly much more than one or two miles, the

amount of acreage of the plant within range of their flight is very limited.

There are two kinds of sweet clover, the white and the yellow. The white is almost universal, while the yellow is seen only in occasional patches. The former is larger, stronger, and more thrifty than the yellow. The latter seems to be almost identically the same thing, only that it is smaller, and the flowers yellow.[351]

QUALITY OF SWEET-CLOVER HONEY.

On this point there is a great difference of opinion. Some assert that it is of very fine quality; but in the vicinity of some of the cities it is pronounced to be a very poor rank stuff. While it is admitted that a little of it in any honey is pleasant, yet the pure stuff is denominated as very poor; yet it seems to be generally admitted that, when the honey is well ripened, its flavor is not bad. But the sweet clover of the cities is probably not pure; that is, the bees have put with it some vile honey from some weed. I have tasted a number of samples that have come from localities where nothing but sweet clover is grown. While the color is of a little greenish cast, and the body good, the flavor is very fair, and I should say the honey ought to rank good enough to sell as white honey. I should hardly consider it equal, however, to white clover or alfalfa.[353]

Sweet clover is quite an important honey-plant in Utah. One of our subscribers, Mr. J. C. Swaner, has had considerable experience with this plant. In an article for *Gleanings in Bee Culture* for Jan. 1, Vol. XVII., he writes:

Sweet clover grows here along the water-courses, moist waste places, along the roadsides, and in neglected fields. It grows from six inches to as many feet in height, according to the location, and it is covered with an abundance of bloom from top to bottom, yielding in most seasons an abundance of nectar, which, after being gathered and stored, produces honey of the very best quality and color. It does not generally bloom in the first year; but in the second it commences about the first of July, and keeps up a continual bloom until killed by frost, furnishing bees with pasturage, generally from the middle of July until the latter part of August.

Sweet clover is sometimes used for pasturage, and also for making hay, if cut when young, though it is a long way behind alfalfa for that purpose. Though it is sometimes relished by stock, very few would sow it for feeding. If eaten while green it is in a measure a cause of hoven, or bloat, in cows. If you wish good milk or butter you had better not feed it to milch cows, as it imparts a very disagreeable taste to it. If eaten off by stock it will soon recover, and produce an abundance of bloom for the bees.

As sweet clover is a blemish, it is not a very hard weed to eradicate, and very seldom troubles cultivated fields, though it will sometimes seed a field; and if such field is planted to grain the following season, it will come up, and is cut off only with the reaper. Next season, if the same field be neglected, it will quite likely be covered with sweet clover, and that, too, sometimes as high as your head. If a field is cultivated as it should be for two seasons, the clover will entirely disappear. The plant requires a little moisture in the soil the first year; but after that it will grow without. I consider it, for my part, a great deal better to see a roadside lined with it than the sunflowers, etc., that generally grow in such places.

Now, to sum up, sweet clover is our main honey crop in this locality. It is our best honey; and said honey, I may say without boasting, compares favorably with the best grades known.

I do not think it will pay to sow it for honey alone, unless on such land as is considered worthless; but I think it would be a benefit to *such* land.

As to the amount of nectar it will produce per acre, I am unable to say; but I think it will compare favorably with white clover; in fact, I think that it produces fully two-thirds of our honey crop in this locality, and I should consider this a poor country for honey if it were destroyed; but as it is, we generally get a crop; that is, the bees generally have some honey to spare. J. C. SWANER.

Salt Lake City, Utah.

H. R. Boardman, in *Gleanings*, Vol. XXII., writes of it as follows:

I am surprised that any bee-keeper of experience, who has had a reasonable opportunity of observing, should report sweet clover any thing less than a first-class honey-plant; and yet I am aware there are a few adverse reports coming from reliable sources.

I am quite sure — yes, I think I know from my own experience and observations with this plant, extending through a period of a dozen years or more — that it is unsurpassed, and equaled only by the noted alfalfa; and these convictions are supported by the opinions of some of the most practical and reliable bee-men of my acquaintance.

The season of 1893 was the first for several years when white clover alone yielded me any surplus, and this, too, with the fields white with its bloom in every direction as far as bees could fly; and yet I should not be warranted in claiming that white clover is not a good honey-plant. It has a world-wide reputation that is unimpeachable. If it were no more abundant than its cousin it would hardly have gained this enviable reputation—certainly not in the last few years.

I think it has been generally conceded by practical bee-keepers that it will not pay to plant for honey alone. This conclusion is undoubtedly a safe one. We must, then, look for some value besides that of honey, in order to recommend sweet clover as a field crop.

AS A FORAGE-PLANT.

I once supposed, as most people do now, that sweet clover was entirely worthless as a forage-plant for stock—that nothing would eat it; but I have demonstrated to my entire satisfaction that horses, cattle, and sheep, will not only learn to eat it, but will thrive upon it, both as pasture and dried as hay, and that hogs are fond of it in the green state. I say, they *learn* to eat it, because most stock have to acquire a taste for it, not taking readily to it at first. I gave it a fair trial for pasture last summer. My horses and family cow fed upon it almost entirely during the dry part of the season. They became fat and sleek, with

out the help of grain or other feed. The milk and butter from the cow showed no objectionable flavor. The amount of feed furnished was something surprising. It has a habit of continually throwing out or renewing its foliage and its bloom; also, when cut or fed back, it keeps it constantly fresh. After gaining a growth of four or five feet in height in dense masses in my pasture it was fed down entirely, even the coarse stalks, so that, at the close of the season, nothing was left. The seeding was, of course, destroyed; but in my desire to put to a severe test the feed value of the crop, this was lost sight of.

Sweet clover, like the alfalfa, sends its great roots down deep into the hardest, dryest soils, thus enabling it to withstand severe drouths as no other plant can. This gives it great value as a fertilizer; and growing as it does upon the hardest, poorest soils, it recommends itself for reclaiming soils too poor for raising other crops. It has a habit of taking possession of vacant lots and roadsides, which has caused some alarm with those unacquainted with its habits, fearing it would spread over the fields and prove to be a pest. I can assure you it will do no such thing. In all my acquaintance with it I have never seen it spread into cultivated or occupied fields to any extent. I have been very reckless with the seed about my own premises; and if there had been any danger in this direction I should have found it out.

Some time during the latter part of last summer (1898) I made a trip through a part of the State where a severe drouth was prevailing. The cattle and sheep looked gaunt and hungry, and were roaming over the farms here and there, adding still further to the look of desolation. In places the cows had been turned into the growing corn, the only green forage in sight. I wondered again and again how it was possible for the stock to escape entire starvation. A field of sweet clover, with its dark-green foliage, would have made a refreshing picture amid this desolation. It would have been more than a picture. It would have supplied a place where it would have been most heartily welcome and appreciated in this trying emergency. I think it will recommend itself, and come to be appreciated soon in such times of severe drouth. It makes a slender growth the first year. It is this crop that is most valuable for hay, and cutting it will not interfere with the second year's growth. The second year it grows coarser; blossoms, seeds, and dies root and branch. If cut for hay in the second year it should be cut just as it is beginning to bloom. A second crop may be cut late in the season. It should be well dried, and it needs good weather to do it in. If cut for seed it may be thrashed and hulled with a machine, as with red clover, or the seed may be sown without hulling.

Now, don't be induced, by the bright picture I have drawn, to seed your whole farm to sweet clover, for it would result in an unprofitable failure, I am sure. But if you desire to test its value, do it on a small scale, with an acre or two, and do it thoroughly. I have found it no easy thing to succeed in making it grow as a field crop, and I would advise sparing no pains in getting it started. When once it gets possession of the ground it will stay if allowed to ripen a late crop of seed. Sow with winter wheat or rye in the spring, the same as other clover.

East Townsend. H. R. BOARDMAN.

It is now well established, that cattle do *sometimes* eat sweet clover green, although some say it is objectionable as pasturage. Prof. Tracy, of the Mississippi Agricultural College, and Prof. Charles E. Thorne, of the Ohio Agricultural Experiment Station, Wooster, speak highly of it as a hay plant, but say, as do others, that stock must *learn* to eat it. Livingston's catalogue says it is "quite valuable for soiling." Its general character as a good honey-plant is well established, and it may be well worth while to give it a thorough test. On some of the alkali lands of the West it is the only plant that will live and thrive.

Farmers' Bulletin, No. 18, of the general government, in speaking of the value of sweet clover on poor soils, says: "As a restorative crop for yellow loam and white lime lands this plant has no superior, and for black prairie soils it has no equal."

CRIMSON CLOVER.

This species, if grown largely, would certainly have one special advantage over any of the other clovers, in that it comes into bloom before any other, and very soon after apple-blossoms; in fact, it fills the gap between apple-bloom and white clover. The color of the bloom is quite distinct from that of the common red clover; in fact, it looks more like a great long luscious strawberry than any thing else. Almost every season, while ours is in bloom, people stop their teams to look at it and inquire about it; and on Decoration day sometimes they come for miles just to get huge bouquets of these beautiful crimson blossoms that almost startle one by their beauty and brightness. In visiting other bee-keepers where they have succeeded in growing it, I found a similar report; and one who has never seen an acre of crimson clover in bloom can scarcely comprehend its beauty, not only by the gorgeous blossoms, but by the beautiful clean bright-green foliage that distinguishes it, as well as the colors of the blossoms, from any other plant.

While this variety (*Trifolium incarnatum*) is not exactly new, the idea that it may be sown in July or August, so as to winter over as far north as the State of Ohio, is a comparatively new discovery. In States south of the Ohio River it may be sown in September, October, and even November. In our locality we obtain excellent results by sowing it the same time we do buckwheat (for particulars see BUCKWHEAT); or it may be sown with all sorts of garden crops, especially those that are to come off soon, all through the months of July and August. With very favorable fall weather it may succeed, or partially succeed, through the

month of September. Some of our best crops have been secured by broadcasting it among early corn, just before it is cultivated the last time. If you want to raise some nice turnips, without any additional expense, mix thoroughly an ounce of turnip seed with five pounds of crimson clover before the clover is sown. In sowing it among corn, as mentioned above, we use a broadcast seed-sower, the operator sitting on the back of a horse so as to get him above the tops of the corn.

SOWING CRIMSON CLOVER IN THE SPRING.

As the clover is a hardy cold-weather plant, sowing it in the spring is not, so far as I can learn, a success. The trouble is, when put in in the spring, even if put in quite early, the blooming time is quite apt to come just when the weather is hot and dry; and a drouth is almost sure to cause a failure. If, however, the seed is put in quite early, and the spring months happen to be cool, with plenty of rain clear into July and August, it sometimes makes an excellent crop. When sown as above, it naturally makes a large amount of feed, equal to any of the clovers; and some of our experiment stations have estimated that a good stand plowed under while it is in bloom is equivalent to ten tons per acre of the best stable manure.

As it comes in bloom a little before any of the other clovers (when wintered over), it may be plowed under for almost any crop. On our grounds we sow regularly four or five acres each year, and have had no failure. It is no more than fair to state, however, that in our locality, the northern part of Ohio, there have been many failures. In fact, one of our standard writers on agriculture says thousands of dollars have been wasted by farmers in attempting to grow crimson clover. The reason of our success is, I think, first, our ground is all thoroughy underdrained; second, it has had large amounts of stable manure, and is comparatively rich. The best stand we ever had, I think, is the present spring, 1899. We had

CRIMSON CLOVER.

several acres of wheat last year that lodged badly. The consequence was, enough wheat rattled out and was left on the ground to make pretty thorough seeding. This wheat grew up in the fall so rank as to fall down before winter. Well, the crimson clover was sown right on the wheat stubble in August; and when the wheat fell over, the clover pushed up through and was thus well mulched through the winter. The consequence is, we have at the present writing, April 25, a tremendous growth of clover and wheat together. This we propose to turn under as soon as the clover is in full bloom—say the middle or latter part of May. We have grown excellent crops of potatoes on crimson clover turned under in this way, for several years past; and, in fact, we have secured a splendid stand of crimson clover by sowing it after potatoes were dug that were planted comparatively early. One year we sowed crimson clover as fast as the potatoes were got out of the ground; that is, as fast as we dug fifteen or twenty rows we worked up the ground with a cutaway and Acme harrow, and sowed the clover. The first put in (in August) wintered splendidly. That put in along the fore part of September did fairly; but where we did not get the seed in until the last of September or fore part of October, it was mostly a failure. Perhaps one other reason why we succeeded is that our seed of late years has been of our own growing. It is an easy matter to grow seed; and where it is worth only $2.50 a bushel, the present price, I think the seed can be grown profitably in our locality—that is, with good ground and other conditions mentioned above.

QUALITY OF THE HONEY FROM CRIMSON CLOVER.

The quality of the honey from crimson clover ranks fairly with that of any of the clovers. Some have called it superior There has not been enough of it in our locality to make a perceptible difference in the honey-yield; but when it is in bloom there are as many bees on the same area as I ever saw, even in a buckwheat-field. As we plow it under while it is in full bloom, the bees are gradually crowded down on to the last heads standing; and after the last head goes under, for some time there will be quite a lot of bees swarming over the ground, apparently wondering what has become of their abundant pasturage in so short a space of time. We have as yet had no reports, that I know of, where hundreds of acres or more are in blossom at the same time, as is often the case with alfalfa, white clover, and sometimes red clover. With a fair-sized apiary it needs many acres of *any* plant to give a good yield of honey.

COLOR OF HONEY. See HONEY, COLOR OF.

COMB FOUNDATION. This is just what the term signifies—a base, midrib, or foundation, of the honey-comb If we take a piece of comb and slice it down on both sides, nearly to the bottom of the cells, we shall get what is practically comb foundation.

The article originally consisted of nothing but the midrib, without any walls; but very soon after, there were added walls to stiffen and strengthen the sheet and to serve as the beginning of the cells.

Since the introduction of foundation, within the past few years, many difficult points have been solved completely; such as how to insure straight combs, how to insure all worker-comb or all drone-comb, as the case may be, and how to furnish the bees with the wax they need without being compelled to secrete it by the consumption of honey.

MACHINES FOR MAKING FOUNDATION.

There are two different and distinct classes of machines for doing this work. One consists primarily of two flat plates, or dies,* operated by a press. The other is made up of a pair of rolls having embossed surfaces, and so adjusted, one above the other, that the die faces will mesh together. Through these the thin sheets of wax are run like clothes through a wringer. The

TEN-INCH FOUNDATION-MILL.

first foundation-machines put out were presses with flat dies; but it was soon discovered that, in order to turn out foundation in a wholesale way, it would have to be done by means of rolls, for then the wax

* There is a machine sold in Germany that uses flat dies without a press. The dies are hinged together, and open like a book. Hot melted wax is poured on the lower die, when the other die is brought down on to it like the closing of a book, before the wax cools. The resultant product is very crude compared with that made off from rollers or a good press.

could be rolled out in continuous or long sheets, and the cost of production materially reduced. While it is probable that the flat dies will make a more perfect foundation, the cost of making by means of them is so enormously increased that nearly all the foundation produced in the world is made on rolls. The best press that has been so far made is the Given; but it is not now offered for sale, and rolls are used almost exclusively.

GIVEN FOUNDATION-PRESS.

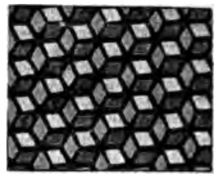
The making of foundation is almost a trade by itself. As full directions are prepared by the makers of foundation-machines I will not go into details here.

FOUNDATION AND ITS ECONOMIC USES.

Comb foundation may be divided into two general classes: That designed for the brood-chamber and that for the surplus-apartment. Each of these general classes is sub-divided still further. For instance, we have what we call "thin super," running 10 to 11 square feet to the pound; "extra thin," 12 to 13; "light brood," used only in the brood-nest, running 8 to 9 feet; "medium brood," 7 to 8 feet. Thin super is generally used for sections, and medium brood for the brood-frames.

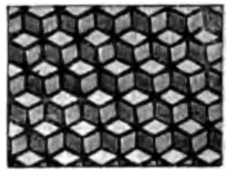
The four illustrations shown above, represent the different grades. The medium has what is called the round cell. This foundation is generally used for the brood-nest, because of its tendency to resist sag

HEAVY AND MEDIUM BROOD.



LIGHT BROOD.

THIN SUPER.



EXTRA THIN SUPER.

while the bees are drawing it out into comb; stronger, because there is more wax in the corners of the hexagons. It has been found that bees will utilize all this wax in the walls, and draw it out into cells. The more wax we can give them in the wall, the quicker will they draw it out into comb. The light brood, running 8 to 9 feet to the pound, has what is called the regular hexagonal cell-wall. As will be seen by comparison of illustrations, there is less of wax in the wall, and less strength to the sheet. On this account it is not recommended that light brood foundation be put into brood-frames that are not wired. The thin super has lighter wall still than the light brood; and the extra-thin super lighter walls still.

The ordinary thin super is generally preferred because the bees are less inclined to gnaw it down; and when they do begin work on it they draw it out more readily. The extra-thin is preferred by some because it is believed it makes less midrib, or what one or two have termed "gob," in comb honey. When too heavy a foundation is used in the sections, especially when full sheets are used, the resulting comb honey, when eaten, is quite apt to show a midrib, or thickened center, and some go so far as to call it manufactured comb because they can not believe that it is as thin and friable as the comb honey they ate "on the old farm at father's." There is some truth in this, and for that reason only thin super or extra-thin should be used; and when one desires as little midrib as possible, and does not care how readily the bees may accept and work out the foun-

dation, the extra-thin super is the one he should use.

Because of the tendency of foundation to cause midrib in comb honey, some have imagined that using a mere starter would remove the objectionable feature; because they argue that nearly all the comb would have to be natural, and it would, therefore, be delicate and friable like the old comb honey on the farm. But it has been shown in the majority of cases that the natural-built will be *store* or *drone*, the cells being larger so the bees can build them more readily. Some recent tests seem to show that natural-built *drone* comb has as much or more wax to the cubic inch than worker comb built from full sheets of thin worker foundation. If the bees, on the other hand, would make their natural comb *all worker*, then we should have a comb, the delicacy and friableness of which would be all that one could desire.

Mr. E. B. Weed, formerly of Detroit, lately of Medina, and now of Cleveland, has probably done more actual experimenting, and spent more time and money on this whole question, than any other man living. Indeed, he is the inventor of what is now known as the "Weed New Process" of making comb foundation, the special feature of which is the making of continuous sheets of wax of any desired length, by automatic machinery. After a long series of experiments he ascertained that in the ordinary foundations on the market there was too much wax in the base and not enough in the wall; that whenever the base is thicker than the bees make it they will rarely take the trouble to thin it down; but, no matter how thick the wall, they will thin it down to nearly or the same thickness as the natural. Going on this theory — a theory which Mr. Weed practically demonstrated — he constructed some special rolls and dies, which were capable of turning out a thin-base foundation. It looks like any other foundation of commerce; but when it is put into plaster, and a cross-section made, it shows that it is very different. If one were to take a knife and attempt to cut across a sheet of foundation, he would not be able, by looking at the edge, to get any sort of idea of the relative thickness of the base and wall, for the reason that the knife would leave burr edges. To overcome this the foundation and comb to be tested should be imbedded in plaster of Paris; and then with a sharp knife one can get accurate sectional views showing the exact relative thicknesses.

For the purpose of more clearly illustrating some of these points we had several pieces of comb and foundation put in plaster.

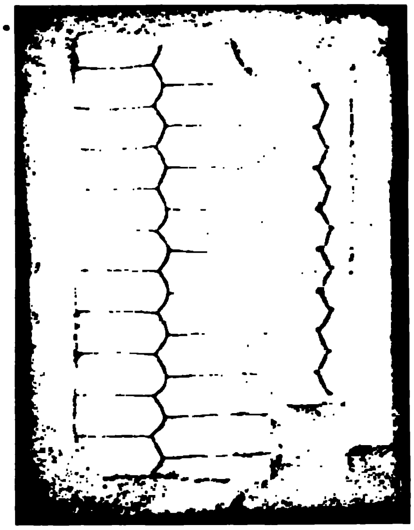


FIG. 15.

After a sharp knife had shaved them down to the proper point they were photographed, and engraved by the half-tone process. This shows the specimens as they are.

Figs. 15, 16* show ordinary thin and light-

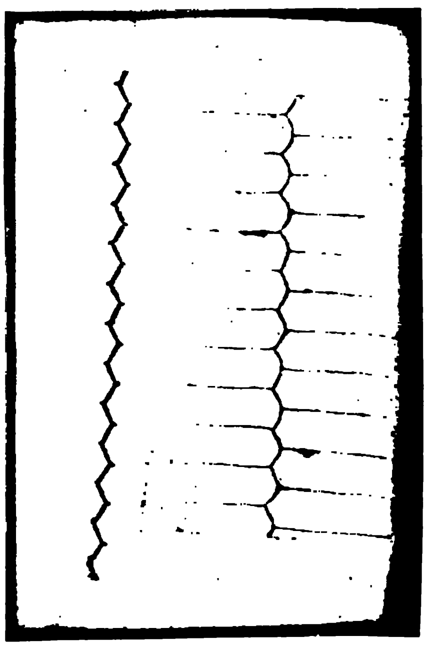
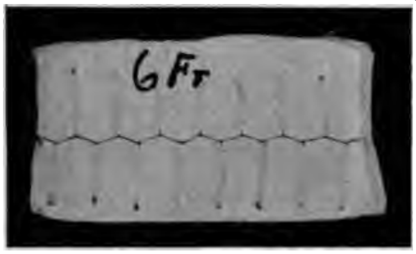


FIG. 16.

* Figs. 15 and 16 were obtained from the *Canadian Bee Journal*.

brood foundation, and the comb that was built off from them by the bees. It will be noticed that the base had not been thinned down to any appreciable extent. Fig 6

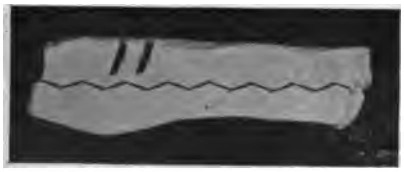


shows a comb that has been built off from foundation having a cross-section shown at Fig. 7. It will be seen that the base is scarcely if any thicker than it was in the

original foundation; while the heavy side-walls in Fig. 7 have been transformed by the bees into very delicate deep cells, showing that it makes very little if any differ-

ence how heavy the wall, the bees will reduce it to nearly or quite as thin as the natural thickness.

Fig. 12 shows the very latest thin super foundation, running about 12 feet to the pound; and Figs. 11 and 13 show respective-



ly the ordinary commercial thin super and extra thin, running 11 and 13 feet to the pound. In the last two the reader will notice that the walls scarcely show, while the base is quite heavy; while in No. 12 the walls are the prominent feature, the base being so light and gauze-like that it barely shows.

Fig. 1, as given below, shows a natural-built worker comb; and although the comb

shown in Fig. 6 was built off from foundation as heavy as 6 feet to the pound, the resultant comb is as light and as delicate as the natural-built product shown in Fig. 1.

But the article made wholly by the bees is not always as light as shown in 1. Under some circumstances the bees build it much heavier, as will be evident by a reference

to Fig. 2, also a specimen of natural-built comb.

Fig. 3 shows a specimen of natural-built *drone* comb. Comparing this with Fig. 1 it

is easy to see how the natural (drone) comb might be a good deal heavier than comb built off from the ordinary thin super foun-

dation, because there is a surplus of wax in both the base and the walls.

Another interesting fact brought out by these plaster casts is that the midrib, or base, of natural-built comb increases in thickness from the bottom to the top. The reason of this is perfectly plain. It is evident that the upper portion of the comb has to withstand the weight of that which is below; and the midrib increases in thickness as it approaches the top of support. One can not but wonder at the beautiful harmony we find in the manifestation of God's laws in the construction of the honey-comb. Thousands of little individuals are engaged in the construction of a certain piece of work. They work in an apparently haphazard way, as I have elsewhere spoken of; and yet when this comb is completed it is one complete whole, stronger near the top than at the bottom.

THE WEED NEW-PROCESS FOUNDATION: HOW IT IS MADE.

Perhaps three-fourths of all the foundation made in the United States, and half of that made in the world, is now turned out by what is termed the "Weed New Process." The new foundation was first put on the market in 1896, and its quality was so superior in point of toughness and transparency that it won favor at once. Indeed, it was so much stronger that lighter weights of foundation could be used all around without detriment. The new process not only produced a very much superior article but made a great reduction in the labor of sheeting, milling, and trimming. The old way was to dip a thin board into a deep vessel of wax enough times to secure a sheet on both sides. It was then cooled in water, and the film stripped off. It was next run through the mills piece by piece, and each time it was necessary to "pick" and "claw" at the ends of the sheets sticking to the rolls as they came through. This operation did not improve the face of the mills, or the foundation. After the sheets were milled they had to be piled up, and cut to a size by hand, causing anywhere from 25 to 33⅓ per cent trimmings that had to be melted over again. Last of all, the sheets were papered by hand and made ready for boxing.

Now if one were to peek into a shop where "New Process" is being made he would see an attendant pick up a cake of yellow wax (60 lbs.) and set it into the machine, as it were, and then he leaves it and goes about other work. After it comes out it is converted into a long continuous sheet rolled up on a bobbin. This bobbin is then put into another automatic machine by the same or another attendant; the machine is started, and when this long bobbin begins to unreel it is fed into the comb-mill, and is cut to size *without waste*. There is a click-clack, and the trimmed sheet is next made to lie squarely over a sheet of paper of the same size as itself, and pick it up; another click-clack, and it takes a hop, skip, and a jump on to the pile; and fingers almost human, and after the manner of a book-cover, true up the pile as evenly and nicely as one could do with his fingers.

FLAT-BOTTOM FOUNDATION.

Flat-bottom foundation has been made, which some think is the best surplus foundation. It is nothing but a sheet of wax, embossed with hexagonal cells inclosing a flat base. While it makes very nice comb honey, yet the testimony of many of those who have tried it is to the effect that it is not readily accepted by the bees, and consequently valuable time is lost. We do know this much, that they remodel and rebuild the cells before drawing them out.

SAGGING OF THE FOUNDATION, AND HOW TO PREVENT IT.

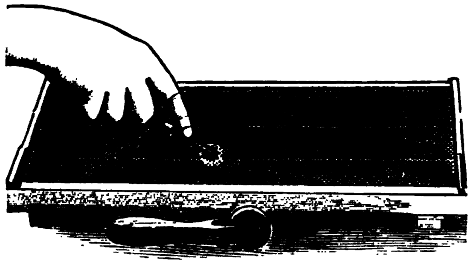
Many devices have been tried to prevent the sagging of the foundation, and consequently slight elongation of the cells, in the upper part of the comb. With the L. frames, this is so slight that it occasions no serious trouble with most of the wax of commerce; but with deeper frames, or with some specimens of natural wax, the sagging is sufficient to allow the bees to raise drones in the upper cells. Paper has been tried, and succeeds beautifully while the bees are getting honey; but during a dearth, when they have nothing to do, they are liable at any time to tear the nice combs all to bits, to get out the paper, which I have supposed they imagine to be the web of the moth-worm. In our apiary I have beautiful combs built on thin wood; but as the bottom of the cell is flat, they are compelled to use wax to fill out the interstices, and the value of this surplus wax, it seems to me, throws the wood base entirely out of the question. I do not like the foundation with wire rolled in it, on account of the greater expense, and because we cannot fasten it in the frames as securely as we can where the wires are first sewed through the frames.

Before the advent of the thick top-bar, we wired all our frames with perpendicular wires, the wires being fed through the top and bottom bars. This made considerable

labor, and besides was hardly practicable with the Hoffman frames described under HIVE-MAKING.

WIRING FRAMES HORIZONTALLY.

In our earlier experiments with wiring frames horizontally, the foundation would bulge between the wires, and yet the Dadants, Hilton, and others, assured us that



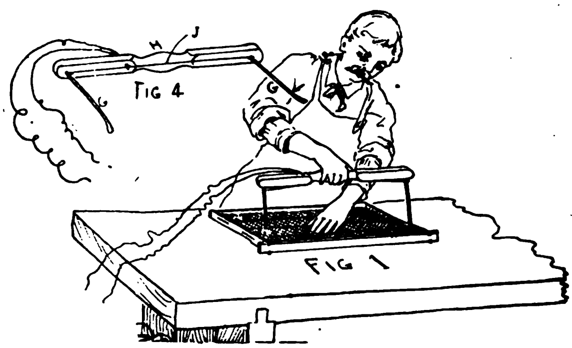
SPUR WIRE-IMBEDDER.

they secured nice, beautiful, straight combs. We have since learned that our trouble was due to stretching the wire too tight. The foundation should also be trimmed one-fourth inch or so shallower than the inside depth of the frame. Our later experiments have shown us that we have by this means secured most beautiful frames of comb. The end-bars should be pierced about 2 inches apart, ⅜-inch from the bottom-bar and 1 inch from the top-bar. This will make four horizontal wires, the right number for the Langstroth frame.

The wire used is No. 30, tinned iron wire. After the wires are in and drawn up tight, the foundation is cut so as to fill the frame, and the wires are then imbedded into the wax by means of one of the various devices for that purpose. During this operation the foundation is supported on a level board cut so as to just slip inside the frame, and come up against the wires. The board is to be kept wet with a damp cloth, to prevent the wax sticking to it. To imbed the wire into the foundation an ordinary "tracing-wheel," such as the women-folks employ, may be used. To make the teeth straddle the wire, every alternate one should be set like the teeth of a saw. Lay the foundation on the board just mentioned, place over the wired frame, adjust the wheel to one of the wires, and with a light pressure "wheel" it along the wire. If the foundation is warm, the wire will be forced into the wax. A far nicer and quicker way is to do it by electricity.

IMBEDDING WIRE BY ELECTRICITY.

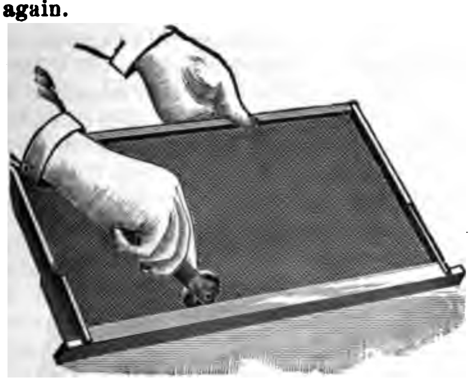
If a wire is too small to carry a given current of electricity, it will heat; and if the current is too great, the wire will melt. Taking advantage of this principle we can, with a proper amount of current, cause the wires to heat to a temperature of, say, 130 degrees Fahr., at which point they will, when properly applied, sink into the foundation; then when the current is cut off, of course the wire cools immediately, and lies imbedded in the center of the sheet of wax. With the ordinary batteries it is not practicable to heat all four of the wires at a time. Accordingly, the average person will have to heat one wire at a time, and this is accomplished as shown in the accompanying illustration. Fig. 4 is a wooden handle, at each end of which are mounted two stiff wires, G G, flattened at the ends. To each of these is attached one pole of the battery. When the current is on, the points G G are pressed on the extreme ends of one strand of wire, while the free hand presses the sheet on top of the wire until it melts its way half way through. The current is now broken by lifting up the handle H. The other four wires are in turn treated in the same way.



Where one has access to an electric-light current, by putting in sufficient resistance he can heat all four wires at a time, thus accomplishing the imbedding at one and the same operation. But the majority will not be so favorably situated, and will, therefore, be compelled to use batteries. The ordinary dry cells, such as can be purchased at any of the stores dealing in electrical supplies, and retailing at 25 cts. apiece, answer a very excellent purpose. Five or six of them connected in "series" will give a very strong current. On every dry cell there will be two connections — one in the center of the battery, called the carbon binding-post, and the other a similar one on the outside edge. One

is called the negative and the other the positive pole. To connect in "series," set the cells down in line; take some bare copper wire; fasten one end to the center of one cell, then run the other end of the wire to the *outside* **post** of the cell next in order. Take **another** wire and connect the *center* of the **cell last mentioned** to the *outside* post of the **next cell, and so on clear through.** If you **have done your work right, there will be one wire leading** from the outs de post of one **cell** at one end and another wire leading **from the** center of the binding-post of the **cell from** the other end of the series. These **two wires** are now ready to connect to the wiring-device shown on the previous page.

Dry cells are what are termed "open-circuit" batteries—that is to say, they will **give a strong current for a while, the strength gradually** diminishing, when they must be allowed to "rest" in order to recuperate **their former strength.** After using the five **or six cells** of battery for an hour or an hour **and a half,** it may be advisable to let them **rest** for two or three hours before using them again.

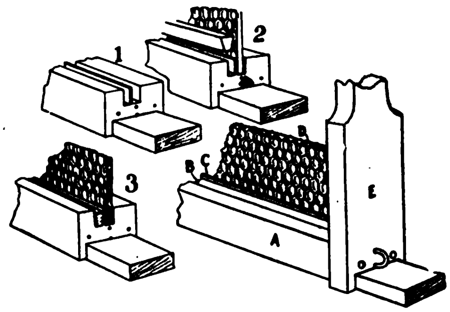


DAISY FOUNDATION-ROLLER.

After the wires have been imbedded to, **say, 100** frames, we use the Daisy foundation - roller. The pressure of the wooden **wheel two** or three times will stick the foundation to the comb-guide.

Another method that is very popular with **bee keepers**, for fastening foundation to the **top-bar, is** that which is shown in the next **illustration.** Mest of the supply - factories **furnish** these kinds of top-bars now because **bee-keepers** generally prefer them. There is **a double** groove, one of which is in the center **of** the top-bar. In this groove is inserted **the** sheet of foundation, as at D. The **wedge-shaped** strip of wood D is then driven **into the** other groove, crowding the central **partition firmly** against the foundation, and **holding it there.**

Many bee-keepers want the starter to fill the section as nearly as possible, leaving a space of only ¼ or ⅜ inch at the sides and bottom. Even with so large a starter as



STARTERS FOR SECTION BOXES.

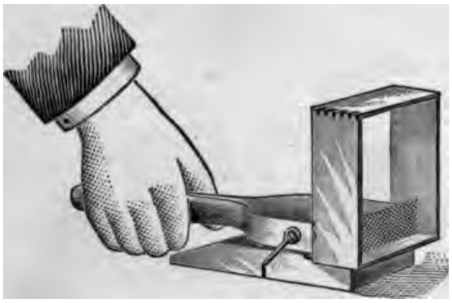
this, the bees sometimes fail to fasten the comb at the sides and bottom. It is especially desirable to have it fastened at the bottom, to prevent breaking out in shipping; but even if long enough to touch the bottom, the bees do not always finish it down. Perhaps a safer way is to fasten a starter at the bottom, ¾ inch wide or deep; then fasten at the top a starter 3¼ inches deep. This makes a sure thing of having the comb fastened to the bottom-bar.

DAISY FOUNDATION-FASTENER.

Hundreds of bee-keepers all over the land, after a thorough trial, pronounce this by all odds the best machine.

The principle of the machine is this: A metal plate or tongue is kept heated by means of a lamp beneath. This plate, by a slight pressure of the hands while holding the foundation, is made to pass directly under and come in contact with the bottom edge of the starter. Instantly the edge of the foundation melts; the pressure of the hands being released allows the tongue or plate to withdraw, and the starter is allowed to drop on to the section, when it instantly cools and is held firm. This methcd of fastening foundation is not only more rapid, but it does much nicer work, and at the same time saves foundation. The pressure method spoken of in opposite column wastes an edge of the foundation that is bedded into the top of the section. This waste

amounts anywhere from ⅛ to ¼ of an inch. All this is saved by the method above. Its manner of construction will be apparent from the engraving.



PARKER MACHINE FOR FASTENING STARTERS IN SECTIONS.

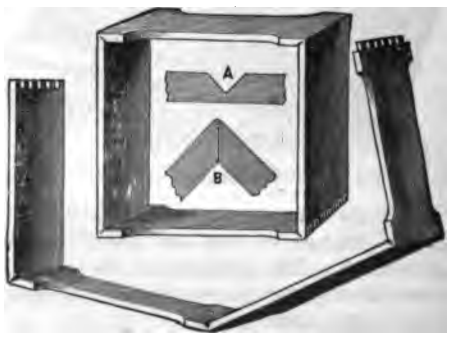
The idea is, to rub the edge of the wax into the wood of the section. The motion of the machine spreads the wax down, and mashes it into the wood, as it were. Above is the Parker machine, which is used quite largely; in fact, many thousands of them have been sold. It does very nice work; but where thousands of starters are to be put in, it becomes a little tiresome on the hands, and besides is not as economical of foundation as the Daisy foundation-fastener.

COMB HONEY. I believe no other subject (unless it be that of wintering) has been so much discussed and so much improved upon as the one now before us. Our forefathers, with their old straw skeps and box hives, thought they had done well when

they had secured the paltry amount of ten or twenty pounds of box honey. With the modern appliances it is possible to secure, in a fair season, an average of forty or sixty pounds of section honey; and occasional reports have shown that from 300 to 400 pounds have been obtained.

By the masses, a good article of comb honey is more highly prized than an equally good article of extracted honey (see EXTRACTED HONEY). While the latter can be, and, in the hands of the expert producer, is, equal in body, color, and flavor to the best comb honey; yet, as extracted ordinarily runs, the comb is a little superior in the qualities I have mentioned.

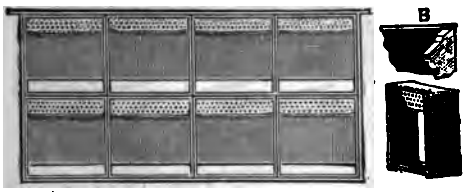
Comb honey can not be counterfeited, and, consequently, consumers are less suspicious of it. For these and other reasons, nature's sweet, in its original form, is in greater demand, and hence commands a higher price. To offset this, it also costs more to produce it, and requires, likewise, more skill and more complicated surplus arrangements to get a gilt-edged article. Years ago, all comb honey was produced in glass boxes. These were about five inches square, fifteen or sixteen inches long, glassed on both ends. They were not altogether an attractive package, and were never put upon the market without being more or less soiled with burr-combs and propolis. As they held from ten to fifteen pounds of honey each, they contained a larger quantity than most families cared to purchase at once. To obviate these and other difficulties, what is popularly known as the "section honey-box" was invented.



It was what was wanted—a small package for comb honey. Thus was accomplished, not only the introduction of a smaller package for comb honey, but one attractive and readily marketable. The retailer was at once able to supply his customer with a small quantity of comb honey without daubing, or fussing with plates. The good housewife, in turn, had only to lay the package upon a plate, pass a common case-knife around the comb, to separate the honey from the section proper, and the honey was ready for the table, without drip.

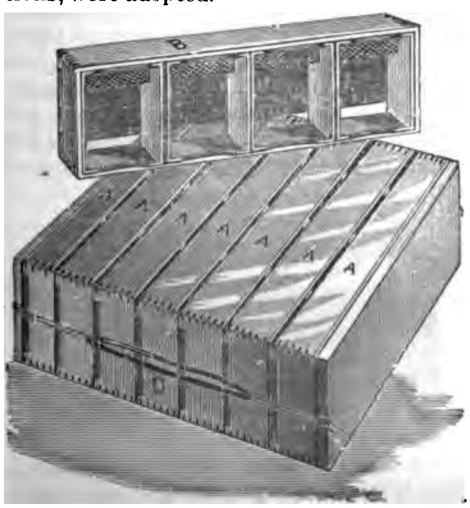
WIDE FRAMES AND HIVE-SUPERS.

The next thing was something to hold the sections while on the hive and being filled. There was a score of different sorts of racks, frames, trays, boxes, clamps, all of which possessed some special features. It would be impracticable to show all of these different devices; but for the sake of illustrating some principles it may be well to mention some of those that are used most largely.



DOUBLE-TIER WIDE FRAME.

What was known as the double-tier wide frame was perhaps the first device for holding sections in the hive. This consisted of a frame of the same depth and length as the ordinary brood-frame, but of the same width as the section, as shown in the illustration preceding. This was used very largely at one time; but in the course of time it was discovered that it had several objectionable features. First, a whole hiveful of them gave the bees too much capacity to start on; and, as a consequence, this discouraged them from beginning work. Second, they did not permit of tiering up to any degree of advantage. Third, it was not convenient to get them out of the hive, and more inconvenient still to get the sections out of the wide frames. For these reasons wide frames, or crates holding only *one tier* of sections, were adopted.



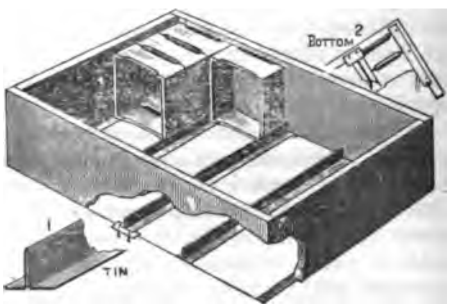
DOOLITTLE'S SINGLE-TIER WIDE FRAMES.

The Doolittle surplus arrangement consists of a series of single-tier wide frames having no projections to the top-bars, although shallow wide frames have been made with such projections.

Both the single-tier and doube-tier shown had tin separators nailed on one side of each wide frame; but in the arrangement shown below there is no provision for a separator.

MOORE (OR HEDDON) CRATE.

As the engraving shows, this is simply a shallow tray of the same depth as the section, plus a bee-space, and is divided off by transverse partitions—these very partitions preventing, of course, the use of separators; but those who did use this style of crate, and use it still, claim they can get along without separators; that they have no difficulty in crating for market all their honey. But the great majority of bee-keepers decidedly object to a non-separator crate, because, while one *can* dispense with the separators, he has to be very careful in handling the honey in putting it into the crate for market, or else there will be bruised and damaged faces to the honey. And then it is true that comb honey produced without separators is never as even and nice as separator honey. Commission men, for this reason, do not like them, and on this account the T super and other forms of separator-cases have the decided preference.



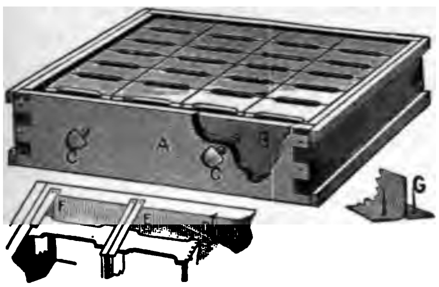
T SUPER.

This is one of the most popular forms of section-crates that was ever devised, and a very large number prefer it to any thing else.

They were so named for the T tins that support the sections. The tins are folded in the form of a letter T inverted, such construction making a very stiff and rigid support.

Some prefer, like Dr. Miller, to have the T tins rest loosely on a little piece of strap iron, both for convenience in filling the supers, and in emptying the same after the sections are filled. But there are others, like George E. Hilton, of Fremont, Mich., who object to loose pieces, and prefer the super with stationary tins, the tins being nailed to the bottom inside edges of the super.

It will be noticed also that he prefers having compression—a feature which he accomplishes by means of wooden thumbscrews and a follower. There is no denying the fact that in any form of surplus arrangement the sections and separators should be squeezed together to reduce propolis accumulations. If there are open cracks or spaces between the sections the bees are sure to fill them with bee-glue.



HILTON T SUPER.

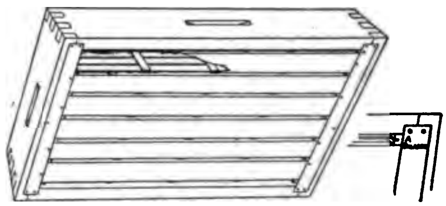
With either form of T super one can use wooden separators, tin separators, or the fences described further along. The projection of the T is just high enough to support the separators at the proper point.

But the T super, perfect as it is, has its objections. If the sections are inclined to be a little out of square, or diamond-shaped, when folded, they will not be squared up in the T super unless an extra set of T tins is used or strips of wood to fill up the gaps between the rows on top. And, again, it is not practicable to alternate the several rows of sections. Sometimes, in a poor honey-flow, it is desirable to move the center row of sections to the outside, and the outside to the center. And still again, four-beeway sections, or plain sections, are not as advantageously used in these supers as in some other form which I shall presently describe.

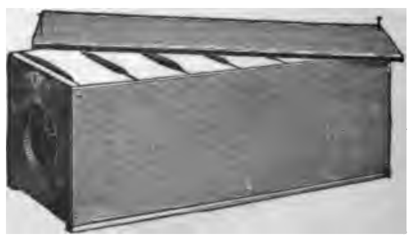
DOV'D SUPER WITH SECTION-HOLDER.

This is the form of super that has been, perhaps, used more largely than any thing else. It is a sort of compromise between the old-style wide frames and the T super. It consists of a series of section-holders that

are open at the top. Each holder is supported at the end by a strip of tin nailed on the inner edge of the ends of the super, as shown in the accompanying illustration.



Four sections in each section-holder are held snugly and squarely in position with no spaces between each row of sections as in the case of the T super. When beeway sections are used the bottom-bars of the sections are scored out to correspond with the beeways. Between each row of sections is dropped a wooden separator, as shown at D. After they are all in place, a follower-board, F, is shoved up against them, and the tightening-strip G, that is thicker one way than the other, is slipped in the narrow way between the follower and the super side, and given a quarter twist. This crowds the follower against the sections, causing compression.



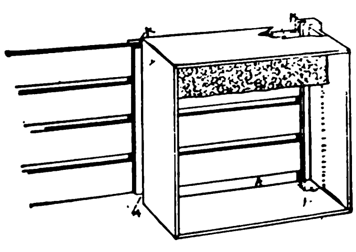
This case is very popular with farmers. Four of them are placed on the hive containing the twelve sections without separators.

When they are filled they are taken off without removing the sections from the case, and are put on the market just as they left the hive. This is a sort of shiftless way, be**cause some** sections will not be entirely fill**ed; but it suits** the farmer who has no time **to do the sorting**, scraping, and getting ready **for market**; and in some local markets this **case** does very well.

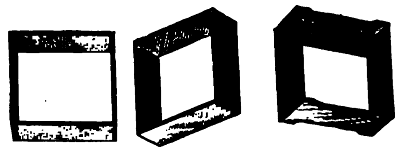
THE FENCE AND PLAIN-SECTION SYSTEM.

The sections and section-supers shown **heretofore** have all been of the beeway type. **Brood-frames**, when in hives, must be placed **a bee-space** apart; so also must the sections. **Almost the** first honey-boxes that were intro**duced had** the bee-space cut out of the top **and bottom** of the sections themselves, so that they could be placed directly in contact with each other or the separator. This kind of section continued almost up to the pres-

ent, but in 1897 there was introduced a section without beeways, having plain straight edges all around. This had been used some ten or twelve years previously by various bee-keepers who found them to be in every way satisfactory. But plain sections (even width all around, without beeways) necessitate some scheme for holding them a bee-space apart while on the hive. Accordingly, a separator or fence was devised, having transverse cleats at regular intervals on both sides, binding the series of slats together—cleats so spaced as to come opposite the uprights in the sections. This will be shown more clearly in the annexed figure. It



will be seen at once that the new system **provides** for a narrower section, and yet this **same section** holds as much honey as one $\frac{3}{8}$ **inch wider, because** the extra width is taken up by the thickness of the cleats on the fences, as shown at A A A in the figure at the bottom of the last column, or what would be in the old section two beeways of $\frac{3}{16}$ inch each. In the cuts shown above there are specimens of beeway sections

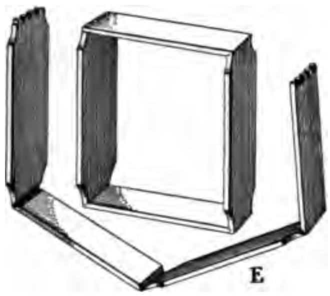


ONE-PIECE V-GROOVE SECTIONS.

and no-beeway, the last being generally termed plain sections. It will be seen that they save quite a little wood, and consequently take some less room in shipping-cases. In other words, the 12 and 24 pound shipping-cases can be some smaller, because it is not necessary to have each comb bee-spaced apart in the marketing-cases, the same as while on the hive. Moreover, the plain straight edges of the new sections offer special advantages in the matter of scraping. There are no insets, often roughly cut (as in beeway sections), to work into and around with a scraping-knife. A single sweep of the knife on each of the four edges will remove the propolis, or, better still, if the blade of the knife is long enough, one can scrape two edges at a time. Weight for weight, and of the same filling, a comb in a plain section looks prettier than one having beeways. The illustration on next page shows beeway sections in one shipping-case, and plain sections in the other. Compare also other cuts a few pages further on with these.

But there is one more point to be taken into consideration. The fences are made up of a series of slats having a scant bee-space between each slat; and as the cross cleats, or posts, are $\frac{1}{2}$ inch shorter than the length of the section, the beeway is very much wider. Instead of being a narrow opening through the top as in the old section, the opening is *clear across* the top, and part way down and up each of the sides. This gives the bees much freer communication, and, in consequence, has a tendency to reduce the size of the corner holes in each section. Then there is that factor, namely, horizontal openings between each of the slats. This allows free communication from one section to another, not only *crosswise* but *lengthwise* of the super. Both theory and practice show that this results, under normal conditions, in a better filling of the boxes A good

many have already testified that they secure much better and more perfect filling of combs in plain sections than in the old style with solid separators, that the bees enter them sooner, and that in some markets bet-



OPEN-CORNER SECTIONS.

ter prices are secured. If the colony is not strong, the old-style super may be the better filled.

Under identical conditions the plain sections will be filled no better than the beeway. If there is any difference in the filling it is because the one offers special advantages in the way of freer communication; for in the ordinary old-style, with solid separator, each section, so to speak, is shut off in a little box by itself, and it has been proven that bees are disinclined to work in little compartments almost completely shut off from the rest. An open-corner section, like that shown at the top of this column, divided off by the means of slatted separators, without cleats, ought to be and would be filled just as well as plain sections divided off by fences; for the conditions will be precisely the same, because the beeways, made part and parcel of these sections, exactly correspond to the beeways (cleats) on the fences. But one would lose many of the advantages of plain sections if he were to adopt the open-corner boxes. They would not look, with even filling, as pretty as plain sections.

SUPERS FOR PLAIN SECTIONS.

In the main, these differ very little from the section-holder super already shown and described for the old-style sections. The

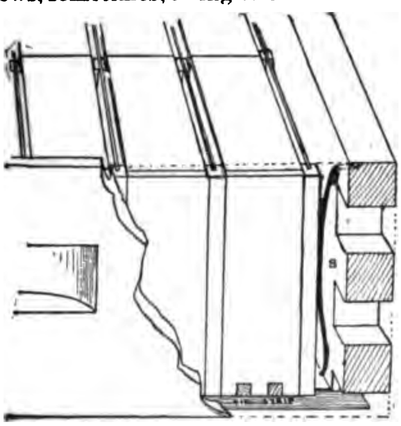
section-holders themselves are the same width as the sections. Between each row of sections in a section-holder is placed a fence,

SHIPPING-CASES WITH BEEWAY AND PLAIN SECTIONS.

the end-posts of the fence resting upon the strip of tin nailed on the bottom inside edge of the end. There is a fence on the outside of each outside row of sections, because it was demonstrated by S. T. Pettit that a perforated divider, or what is exactly the same thing in principle, the fence, when placed between the outside rows and the super sides will result in having those outside rows of sections filled, in many instances, as well as those in the center. The reason of this is, that it places a wall of bees on each side of the fence, between the comb honey and the super side; and these walls of bees, so to

speak, help to conserve the heat so they can draw out the comb and complete the sections on the outside as well as in the center. Both theory and practice sustain the proposition.

In the modern supers, and especially in those designed for plain sections, there are used, instead of wedges and thumbscrews, steel springs that bear against the center of the fence as well as against the two ends, as shown at S in the accompanying illustration. The wedges, tightening-strips, or thumbscrews, sometimes, owing to excessive damp-



ness, cause trouble by every thing becoming swelled fast; but the springs at all times present a yielding pressure; and, what is of considerable importance, they are not affected by propolis; at the same time they effectually close up all little air-gaps or interstices between the sections and fences.

HOW TO PRODUCE COMB HONEY.

Bee-keepers are not all agreed as to the exact methods to be employed. So much depends upon the man and the locality, and the source of the honey, that some slight deviations have to be allowed. It may be stated that all are agreed that a good strong working force of bees, of the right working age, should be in readiness just before the expected supply of nectar. It is penny wise and pound foolish to let the bees run short of stores in spring, just at the time of the year when brood-rearing should be stimulated to its utmost. If necessary, stimulative feeding should be practiced. If the weather is not cool, brood may be spread to advantage. This is done by inserting an empty frame of comb between one or more pairs of frames filled.* But this should not be done if there is a scant supply of bees, or if the weather is cool. If the bees need more room, as some of them undoubtedly will, then put on another story. If colony is strong enough let them keep it, even after putting on a super of sections. If it is not strong enough take away the upper story, crowd all the frames of brood into the lower brood-chamber, and then put on the comb-honey supers. If we can get a colony strong enough the bees will boil up into the super when it is put on. But all of these plans will be brought to naught unless the queen is a good one.

WHEN TO PUT ON SUPERS.

If the colony is in one story and the bees begin to come in from the field, and combs are whitened near the tops, frames fairly well filled with brood and with honey, I put on supers. If I have supers containing half-depth extracting-combs, I prefer to put these on first, even if I desire to produce comb honey, for the bees will enter them much more readily, and begin storing above. Then when they *are once well started* I raise the extracting super up and place under it a comb-honey super containing sections filled with *full sheets* of foundation. (See COMB FOUNDATION.)

The usual practice is to put the comb-honey super on at the start; but in my experience, Italians especially are loath to enter the boxes. If they *once get into the habit* of going above, they will keep it up, even if the super is changed. The extracting-super can remain on top of the same hive on which it was put in the first place, but I would put it on some other colony to give it the "upstair fever," after which it should be replaced by a comb-honey super. After a little there will be some filled extracting-supers as well as those of comb. By proceeding on this plan I have found that I can produce just about as much comb honey as I should if I put the comb-honey supers on in the first

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* See SPREADING BROOD.

place, with the additional advantage that the extracted honey obtained is just so much clear gain. Read what a correspondent of *Gleanings in Bee Culture* has to say of it:

I have been, for several years, very much interested in trying and comparing different methods of handling bees for comb honey. I have been in the business for eight years, and have had fair success. For the first five years I tried a different method each year. Three years ago I tried an experiment that succeeded so well I have followed it up, and have in a measure overcome the two greatest difficulties that I had to contend with—loafing and swarming. We use the eight-frame Dovetailed hives with section-holders for 4¼×4¼ sections. Our bees would always begin to loaf or hang out on the front of the hives when we put on the sections, and most of them would do but little in the sections until they had lost several days, and then would swarm, thus losing several days of the first alfalfa bloom.

I had sixty colonies of Italians in my out-apiary, and in trying my experiment I tried to be fair. I took 30 supers of half-depth extracting-frames full of comb from the home apiary, and put them on 30 hives in the out-apiary at the same time that I put sections on the other 30 hives. In four or five days the extracting-combs were full of new honey, and the bees excited and busy at their work, while most of those having sections were loafing, and some had swarmed.

I raised the combs by putting a super of sections between them and the brood-nest. At the end of two weeks from putting on the combs those sections under the combs were better filled than those on the hives that had no combs. As soon as the combs were sealed I put them away to extract, having that amount of honey extra, and the bees started nicely in their work. I had only about a third as many swarms from those hives as from the ones with sections and no combs.

I liked the plan so well that last year I had enough of those little combs built to furnish a super of them to every colony that was to be run for section honey.

I tried the plan again this year, and from 75 colonies at the out-apiary I had 8000 fine white marketable sections, about 500 lbs. of unfinished and imperfect sections, 1500 lbs. of extracted honey, and 60 lbs. of beeswax, and two barrels of vinegar. We got short of fixtures, and I had to cut out some of my little combs and have the bees build them again to keep them at work. I forgot to mention that we sell a lot of those combs to families for home use, as we can sell them cheaper than sections. When we cut them out we do so after extracting, and then the washings make good vinegar, and the wax goes into the solar extractor, and is of the best quality. We leave half an inch of comb at the top of the frame, to save putting in foundation. I do not believe we shall ever be able to overcome swarming entirely, but I believe my plan stops the loafing better than any thing else I know of. We had 57 swarms this year, but no loafing in the out-apiary. We have bought an extractor for that apiary, and will continue to run on that plan to start them to work. After the first super of sections is well started there is no more trouble about loafing. My neighbor's bees loafed and swarmed through all the best of the season, while mine were hard at work.

Mancos, Col., Nov. 17, 1898. MRS. A. J. BARBER.

But there may be some who do not care to produce extracted honey, or who, perhaps, do not have any extracting-supers of any sort; and it may be true, also, that the locality or the bees, or the bee-keeper, would render such a procedure as already explained not as desirable as the more direct method of putting the comb-honey supers on the hives *at the start*. Under such conditions you will proceed as given below.

WHAT TO DO WHEN BEES REFUSE TO ENTER THE SECTIONS.

At times bees will show a disposition to loaf, and consequently a disinclination to go into the sections. They will hang out in great bunches around the entrance, while the surplus-apartment is left almost entirely vacant, to say nothing of foundation not being drawn out. This condition may be wholly due to the backwardness of the season. During those years (which are not frequent) when the bees have not yet filled their brood-combs after the honey season is nearly over, and, as the days progress, make little if any increase in the quantity of honey, we can not expect the bees to go above until all the available cell room below has been filled, as a rule. When this is crammed full, and there is a rush of nectar, they will commence work in the sections. We will suppose you have a fair average season, and some colonies are storing honey in the supers, and others are not. With the latter, the trouble is clearly with the hive or with the bees. Some bees are much slower in going above than others. If honey is coming in freely, they can be baited, usually, by placing a partly filled section or two, of the year previous, in the center of the super. Sometimes a little bit of drone brood similarly placed may be used to advantage, but I should hardly recommend it, because it is liable to result in the discoloration of the sections next to it.[58] If the use of partly drawn-out sections, as explained, does not succeed in baiting the bees, go to a hive where the bees are already working in sections, if you can have access to such a one, and remove sections, bees and all, that are actually at work drawing out the comb, and place them on the hive that won't go above. This will start any hive at work in the sections that contain bees enough to go to work. The sections should contain full sheets of foundation, because it has been shown, over and over again, that bees are much more ready to accept full sheets than starters. If you have complied with this, perhaps the hive is not properly shaded, and, as a consequence, the surplus-apartment is overheated by the direct rays of the sun. In this event, if you can not extemporize some kind of

shade, use a shade-board, and smoke the bees above. (See A**PIARY**.)

If the methods given still fail to force your bees to occupy the sections, and you have **followed faithfully** the instructions, the trouble **may be** because honey is not coming in **sufficiently** rapid because the brood-nest is **not yet filled**, or because the colony is too **weak. It requires** *strong* colonies under *any* ***conditions*** to do much work in the supers. **The hive should be boiling over with bees.**

TIERING UP.

If honey is coming in at a good rate, you **may expect** (if the bees have got started **above) that** the super, or case of sections, **will soon be filled** about half full of honey—**the sections being in different** stages of com**pletion.** When the super is about half filled **with** honey, raise it up and place another **empty super** under it. About the time this **reaches the** condition of about half comple**tion, raise both** supers and put under anoth**er empty one.** This process of "tiering up," **or "storifying,"** as it is called by the Eng**lish, may be continued until three or four high, depending** upon the length of the honey-flow **and the amount** of nectar coming daily. In **the mean time** the ripening process of the **honey in the first supers** continues. Usually **it is not** practicable to tier up more than **two high.**

CAUTION.

Care must be exercised in tiering up, or a lot of unfinished sections will be the result. When the honey-flow is drawing to a close, and you discover that there is an evident decrease in the amount of nectar coming in, give no more empty supers. Make the bees complete what they have on hand, which they will do if you are fortunate enough in your calculations as to when the flow of nectar will end. If uncertain whether another super is needed or not toward the close of the harvest, it is often advisable to put another super *on top*.[57] The bees are not likely to commence on this till they really need it. It is impossible to give general rules on tiering up; but with the assistance of the foregoing you are to exercise your own discretion.

WHEN AND HOW TO TAKE OFF SECTIONS.

Usually it is not practicable to wait till **every section** in a super is complete; that is, **until every** cell is capped over. Those sec**tions most** liable to be unfinished will be in **the two outside** rows, and these the bees will **be long in** completing. If the honey-flow is **over I would** not wait for them to be com**pleted, but would take the whole super off at once. The longer it remains on the hive,** the more travel-stained the honey will become, and the more it will be soiled with propolis. Bees have a fashion of running through their apartments with muddy feet, and in this particular are not so very much unlike their owners. However, if you desire a really fine, delicious article of comb honey, one pleasing to the tongue and not so much to the eye, and are not particular about the white marketable appearance of the cappings, leave the super on the hive for two or three months. Most bee-keepers agree that comb honey left on the hive acquires a certain richness of flavor not found in honey just capped over. Although such honey is really better, it is not quite so marketable.

HOW TO GET BEES OUT OF THE SECTIONS WITHOUT BEE-ESCAPES.

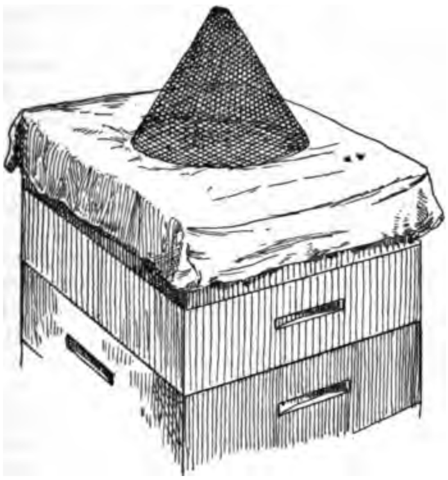
There is one danger in leaving honey on till after the honey-flow. As soon as you open the hive, the bees, especially hybrids, are apt to uncap and carry some of the honey down. Whether you leave it on the hive or whether you remove it as soon as capped, the methods of taking off and getting the bees out will be much the same. In the former case, some supers may not be filled with honey, although a glance at the top may show nice white capped combs. Satisfy yourself by lifting one up and looking under. If capped below, it may be removed. To take off*, blow smoke into the top of the super for a little while, to drive most of the bees down; lift off the super, and set it on end near the entrance (not as it sits on the hive, or you will kill bees). If honey is coming in freely, robbers will not molest, and in two or three hours the bees will have left the super and gone into the hive.

Until you have had some experience, perhaps your safest plan is, never to set a super of honey by the hive. Sometimes it may be safe to let it stand there all day when the bees have more than they can do on the flowers; but, again, all at once it may start the bees to robbing, and demoralize them generally.

After removing as many bees from the sections as possible, take the crate[355] or crates, with the bees adhering and set them upon end on the ground. If many, pile them one upon another, alternately crossing. Now take the folding tent (see T**RANSFERRING**) and place it over the crates. Before doing so, however, you should make an oblong hole (if there is not one there already) through the mosquito-bar near the peak of the tent. The

* The plan here given is the one recommended by Dr. C. C. Miller, Marengo, Ill.

bees, on leaving the crates, will fly bumping their heads against the sides of the tent, until they arrive at the peak, where they will make their escape through the hole referred to above; but not one will have sense enough to come back by the way it came. In this way the crates of sections will soon be freed from the bees; and, as no bee will enter by the hole from the top, there will be no danger from robbing.



MILLER'S TENT ESCAPE.

Dr. Miller, carrying out the idea of the bee-tent, went a little further and constructed a miniature bee-tent to set directly over the pile of filled supers.

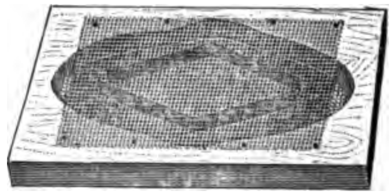
MARTIN'S SUPER-JOUNCER.

Another very excellent plan for getting bees out of supers without a bee-escape is described by Mr. John H. Martin, under the *nom de plume* of "Rambler," in *Gleanings in Bee Culture.* It is simply a framework of suitable size bolted together, having four stout legs, braced and cleated in such a way as to hold a super of sections right over a cloth tray just beneath. Super, framework, and all, or "jouncer," as Mr. Martin calls it, are raised up and set down on the ground with a quick sharp jar. This "jouncing" is repeated in rapid succession until all the bees are shaken out on to the cloth, from which they can easily be dumped in front of the hive. The work can be done more quickly than it takes to tell it.

There are those who are strong enough in their arms and back to shake nearly all the bees out with a tremulous motion without a jouncer; but it is back-aching work with the best of them.

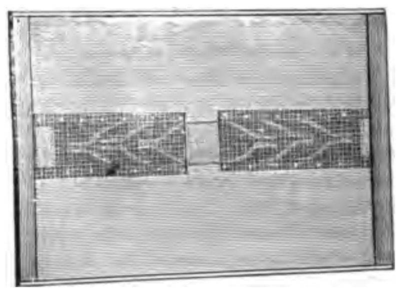
BEE-ESCAPES.

The first escapes were in the shape of vertical wire-cloth cones, as shown in the Alley trap in DRONES; but as these took too much room in the super, other forms of escapes had to be devised in which cones would in a sense be laid on their sides. One of these is shown in the Reese horizontal bee-escape.



REESE'S HORIZONTAL BEE-ESCAPE.

The same principle carried a little further is shown in the next engraving, called the Lareese escape. The two boards forming the escape-board proper are spaced about two inches apart. On each side are nailed strips of wire cloth as shown, and between these strips are placed a series of horizontal cones also of wire cloth. Strips of wire cloth like a letter Y are fastened between the strips of wire cloth nailed on both sides. The Y's are made by bending a strip of wire cloth into a sort of trough. The bottom of the trough is then slit through the middle nearly to one end. The ends are spread, and nailed against the two edges *between* the boards. Six of these are thus fastened as shown by the light lines. This is Reese's horizontal wire-cloth-cone escape improved by John H. Larrabee. That it works successfully is evidenced by the fact that W. G. Larrabee took off with it, one season, several thousand pounds of extracted honey without shaking or brushing a comb.



LAREESE BEE-ESCAPE.

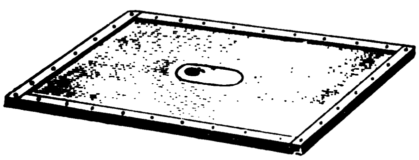
PORTER BEE-ESCAPE.

The escape shown next page is, no doubt, ahead of any of the escapes heretofore represented. The wire-cone escapes do not

always prevent the bees from getting back the way they came. But the Porter is constructed on a principle that effectually prevents any return. Every bee has to pass between the points of two very sensitive springs that readily yield as each one passes outward, closing up and absolutely preventing its return. With these escapes one can clear the bees from the supers very easily, and with but little labor.

The Porter is mounted in a board as shown, bee-spaced on one side, and is as large as the top of the hive.

My method of putting on one of these escape-boards is as follows: With a screw-driver, putty-knife, or pry, loosen the super so that propolis connections will be severed or broken. Now with one hand tilt the up super at one end enough to make a gap, and with the other hand blow in two or three whiffs of smoke to drive the bees back. Next lift one end of the super up so that it will stand at an angle of about 45 degrees. With the free hand set down the smoker and



pick up the escape-board, which should be leaning conveniently against your person. Set this on top of the hive as far as it will go, bee-space side up. Let the super down on the escape-board gently, and, last of all, bring the escape-board and super so they will align with the hive.

You will find this method saves hard lifting, saves angering the bees, and saves killing them.

The best time to put on Porter escapes is at night. If thirty or forty of them are put on, the next morning about nine o'clock there will be about thirty or forty supers ready to come off, with hardly a bee in them. If there are three or four bees left, or say a dozen, they will usually take wing as soon as the super is uncovered. If not, one or two whiffs of smoke, and a shaking, will dislodge them.

THE ADVANTAGES OF THE ESCAPES.

In smoking out most of the bees and then letting the remnant of them escape through the tops of bee-tents and fly home (if they can), there will be the young bees that can not fly home, and these are quite apt to become lost. The smoking is also liable, at times, to cause the bees to uncap the honey. With any of the last four escapes, both of these difficulties are nicely avoided. The young bees go down into the hive, and every thing is done so quietly that there is no uncapping, no interruption of the work of the bees to and from the entrance, and the labor of the apiarist is also saved.

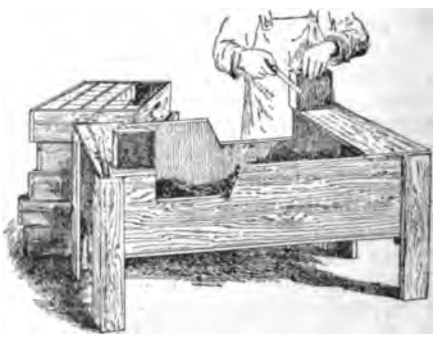
Any of the last three named can be used for EXTRACTING, which see.

SCRAPING SECTIONS.

In order to make sections present a clean marketable appearance, all propolis should be scraped off. Some prefer, for this purpose, a case-knife; others, an ordinary dull jack-knife. But whatever implement you use, scrape the sections nice and clean. Be careful not to gash into the honey. Before you commence the operation you had better put on some old clothes, because the particles of propolis will be almost sure to ruin good clothes.

BOOMHOWER SECTION-SCRAPING TABLE.

Mr. Frank Boomhower, of Gallupville, N. Y., has a section-scraping table like the one shown below. As will be seen, two scrapers can work at a time, the sides of the box, or



tray, being cut away in such a way as to allow a knife to scrape down clear past the edge of the section. Each section, as it is scraped, is put into the shipping-case. I have seen this table in operation and know that it is just the thing for hand scraping.

UNFINISHED SECTIONS.

The more carefully the apiary is manipulated in the matter of working for comb honey, the fewer will be the number of

unfinished sections; but all such are not always the result of improper working of the colonies. With the best of care a sudden stoppage of the honey-flow will throw on the bee-keeper a lot of these sections; for such stoppages of the nectar supply, no one can foresee in some localities. In the alfalfa regions, and in some other places, it can be told within a few days when the honey will stop; it is then possible to so arrange the supply of sections on the hives as to leave very few of them unfinished when the season does finally close.

HOW DR. MILLER PREVENTS AN OVERSUPPLY OF UNFINISHED SECTIONS.

Dr. Miller takes off his supers as soon as a majority of the sections in the super are finished. These latter are set aside to be scraped and cased for market, while those unfinished are set back into the supers—the supers to go back on the hives immediately, consequently *before the honey-flow stops*. By proceeding thus he manages to have few unfinished sections at the end of the season. Those that are returned to the hive he fittingly styles "gobacks." These, as fast as they accumulate in the honey-room, are put into the regular hive-supers. Part of these goback supers may be placed on colonies that show a special aptitude* for finishing up work already begun in sections, and a part may be placed on the regular colonies already at work on their own sections. The great advantage of this plan is that it allows the sections to be taken off before all in the super are finished, consequently before any of the central ones have lost their virgin whiteness.

Such a plan of procedure is possible only in localities where the honey-flow lasts sufficiently long, not only to fill two-thirds of the sections full in the supers, but enough longer to finish out supers of gobacks placed on hives afterward.

In any case, some unfinished sections will be on hand at the close of the season; for if the surplus be all stored in sections it is not possible to give the exact number of sections that will be finished.

If honey is quoted in the open market at 12 or 15 cts., these unfinished boxes will probably not bring more than 8 cts. per lb. As a matter of course, they do not look finished. Some of the cells are capped over, and those that are not capped are likely to daub cases as well as sections. At the very best they are slow sellers, and should be either completed on the hive by feeding back *after the honey-flow*, or be otherwise disposed of.

*Some colonies are better at finishing up work already begun than at starting it from the raw foundation.

FEEDING BACK AFTER THE HONEY-FLOW TO COMPLETE UNFINISHED SECTIONS.

Of course, nothing but the best grade of extracted honey should be fed. Under no circumstances should sugar syrup be considered. The supers of "gobacks" should be placed on the hives, and then on top of them a large feeder, something like the Miller, as described and illustrated under FEEDING. The honey should be diluted to about the consistency of raw nectar, or in about the proportion of ten pounds of water to one of honey. The mixture should be heated, and then placed in large feeders toward night. At that time there will be less trouble from robbers; for whenever bees are fed they will be apt to rush out of the hive pellmell, and cause a general excitement.

While some have been successful in feeding back, and making salable unfinished sections, the majority of bee-keepers, I believe, have given it up as unsatisfactory. In the first place, the work has to be done at a time of year when robbers are the worst. The cappings will appear to be water-soaked, and at other times travel-stained. During a dearth of honey, bees have nothing to do but gather propolis, dirt, every thing and any thing that will chink up and fill up cracks and crevices, and the result will be that the fed-back comb honey will be dirty-looking compared with that made during a natural honey-flow.

Feeding back can be made to pay under the most favorable circumstances and management; but even then only about 3 pounds out of 5 of honey fed will be obtained in the comb honey. At other times there is no appreciable loss. A great deal depends on how the work is done, and when. I would advise the beginner to try feeding back on a small scale, to weigh up the honey fed, and the amount of comb honey received over and above what was placed on the hives in the first place in an unfinished state.

WHAT TO DO WITH UNFINISHED SECTIONS.

Some prefer to dispose of unfinished sections by selling them around home for less money, or using them exclusively for home consumption. The honey, for eating purposes, is practically just as good; and it is the practice, in many bee-keepers' families, to consume all such sections if they can, reserving out those that are marketable and well finished, to be sold.[359]

Some bee-keepers consider them very valuable for baits; that is, they place one of these in the center of a super to bait the bees above, as has already been explained. Others make it a practice to uncap and then place them in stacked-up supers a few rods from the apiary. A very small entrance at the bottom of the pile. large enough for one or two bees to pass at a time, is provided. By this slow method of robbing, the bees will empty out the honey and carry it to the hives much more cheaply than the bee-keeper himself can afford to do it by means of the extractor. While this slow robbing may cause a little disturbance in the yard at the time, it does no particular harm. But mark this: Never give the bees a wide entrance at the bottom. It should be only wide enough to allow one or two bees to pass at a time. This is known as the Miller plan, having been, I believe, originated by Dr. C. C. Miller. Taking every thing into consideration it is the safer one to follow; but where one is an expert bee-keeper, and has a large lot of unfinished sections for the bees to empty out, a plan originated by the late B. Taylor is perhaps better. Dr. Miller, who now uses the plan, thus speaks of it:

For a number of years I have used the Taylor plan at the close of every season. All sections that are less than half filled are put in supers in the shop cellar, and the door kept closed till the whole business is over, and *all* that are to be emptied are in the cellar. The supers stand on end so as to be all open, or piled in piles crossing each other. When no more are to be taken into the cellar I open the door, and say to the bees, "Go in." They go in, I assure you. The air is black with bees at the door, and they do more or less sailing about in the vicinity. Sometimes they do a little tearing of the sections, but not much. There is too large a surface for them to cover. Gradually they give up the job as the supply ceases, but the supers are not taken away till a week or two after the bees have stopped working on them. They might as well be put in the open air, only they are safe from rain in the cellar. Please remember that this is what I do at the end of every harvest after the flow has stopped.

As a matter of fact, I use the Taylor oftener than the Miller plan. It depends on the number of sections to be emptied in proportion to the number of bees. Whether little or much is to be emptied, I am not afraid of a rampage. I will set a super of sections on top of a hive and let the bees rob it out, and there will be no rampage. But I will be exceedingly careful not to take away the super until all the honey is cleaned out, *and until at least 24 hours after the bees have stopped trying* to find any more honey there. Take away the super while the bees are at work at it, and wholesale destruction would follow.

SHALL WE USE SEPARATORS?

A few years ago there was considerable discussion among prominent bee-keepers as to whether separators could or could not be dispensed with profitably in the production of comb honey. Some stoutly maintained that they could, and others just as strenuously asserted that they could not. The former class urged that they could secure more honey without separators, and consequently that they could put up with the inconvenience of some few sections bulged out beyond the sides. While the latter class were ready to admit that *perhaps* a little more honey could be secured by the non-use of separators, they asserted that they obtained so much uncratable honey, and were put to so much inconvenience in trying to so arrange the sections as to have them built out evenly, that they never wanted to dispense with separators. It should be remarked right here, that, with the narrow beeway sections, 1⅞, 1½, or 1⅝, the separators are not so necessary as with the wide ones, such as 1⅞ or 1$\frac{15}{16}$. Full sheets of foundation in either case greatly lessen the need of their use. But plain sections *should always* be used with fences or separators. At the present time, however, by far the greater majority of the producers of comb honey advocate and use fences, separators, or something of that sort; and as our experience in former years was so unsatisfactory without separators, we are compelled to agree with the majority.

WOOD OR TIN SEPARATORS.

Objection has been made to the tin separators, because of their metallic coldness. It is urged, that the smooth sides of the tin are not congenial to the bees, and that, furthermore, the expense of separators made of tin is greater than most bee-keepers can afford, in consideration of the low price of their product. Partly for these reasons, and partly for others, wood separators costing an almost insignificant sum have been made. They are sometimes cut out on a slicing-machine, and are really thin veneer wood, cut to the size of the separator. Those cut with a saw are much better because the grain is not broken in shaving. The thickness varies from 28 to the inch up to about 16. The preference seems to be in favor of the thicker ones.

WHAT SIZE OF SECTION TO USE.

To answer this question intelligently for oneself, it will be well to consult the honey-market reports. As a general rule, sections holding an even pound of honey are preferred by consumers, and, of course, they bring a higher price. Notwithstanding this, few bee-keepers think that more honey can be secured in two-pound sections than in

the smaller sizes. Most bee-keepers, however, are not so sure that it makes any difference to the bees; and while the fact remains that, in most markets, they sell for from one to two cents less per pound than the one-pound, it behooves every bee-keeper to think carefully before he decides on adopting two-pound sections. The size of section which seems to have the general preference is 4¼ inches square and 1⅞ inches wide for the beeway style, and 1½ inches for the plain.

NARROWER SECTIONS.

Some markets demand a smaller package. Instead of going to the expense of making smaller sections, supply-dealers have been in the habit of making the regular 4¼ sections narrower—1½, 1⅝, 7 to the foot, 1¼, 1⅜. The seven to the foot hold about three-quarters of a pound, while the 1¼ and 1⅜ hold about half a pound.

There is a very great advantage in diminishing the *thickness* of a section instead of the *size*, for this reason: They will fit most of the surplus arrangements in use, and can be shipped readily in ordinary shipping-cases, with but little trouble. In Canada the narrow sections have the preference.

FOUR-BEEWAY SECTIONS.

A few years ago these were talked of considerably; and it was stated at the time that the bees would enter them more readily; that they would be filled better, and have a better appearance for market. Very little attention was paid to them in this country, although they have been used continuously in Great Britain ever since; but since the plain sections and the fence have demonstrated the value of free communication crosswise and lengthwise of the super, the open-side sections are being talked of more now than they have heretofore; but, like plain sections, they require a special kind of separator; and the cases for holding them would be just about as expensive. If one expects to make a change it would be as cheap, and better, for him to adopt the plain section.

TALL VS. SQUARE SECTIONS.

The standard section for a good many years is and has been 4¼ in. square; but, notwithstanding, during all this time, a good many bee-keepers, principally in New York, have been using a section taller than broad. Capt. J. E. Hetherington, who has the reputation of being the most extensive apiarist in the world, uses a section 3⅝x5. Other bee-keepers in New York use them slightly larger or slightly smaller, but of the same proportion. (See HIVES.)

Some of the reasons that have been urged in favor of the tall section are as follows:

1. Weight for weight, and for the same thickness of comb, a tall section presents a bigger appearance than the average square one. In the 4x5 tall plain section, for example, 1⅜, we have about the same actual weight as the 4¼x4¼x1½ plain; and yet, as

COMPARATIVE SIZE OF TALL AND SQUARE SECTIONS.

will be seen by the engraving, the former looks to be the larger. As a result the tall box brings in some markets anywhere from one to two cents more per pound, and in other markets it brings no more. If this were the only reason why the tall box were preferred, we should say nothing about it here; but there are other reaons for this preference.

2. By long association we have come to like the proportion of objects all about us that are taller than broad. Doors and windows of their present oblong shape are much more pleasing than they would be if they were square. Nearly all packages of merchandise, such as of drugs and groceries, are oblong in shape—that is, taller than broad. To further cater to this taste, brought about by long association with the common objects round about us, the tall section was introduced; and outside of its relative appearance of bigness as compared with the square box, very many consider the tall one much more pleasing.

3. Mr. R. C. Aikin, one of the closest observers in all beedom, lays it down as a rule that "*in comb-building the downward progress exceeds the sidewise in the proportion of about three to two.* . . If, then, comb construction goes on in this way, a section as wide as deep will be finished down the center before it is at the outer edges." A tall

section, then, more nearly conforms to the natural instincts of the bees.

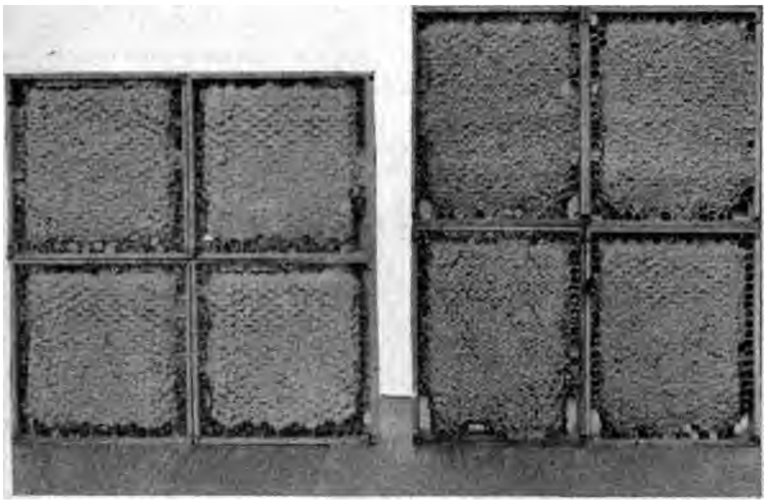
4. A greater number of tall sections holding approximately a pound can be accommodated on a given hive surface.

5. A tall section will stand shipping better, because the perpendicular edges of contact of the comb itself are greater than in a square box.

Just how much there is in these points I am not able to say from experience; but certain it is that the 4x5 and 3⅝x5 have of late been growing more and more popular with bee-keepers and with commission men, especially in the eastern markets.

GLASSED SECTIONS.

Glassed sections are simply sections of comb honey with squares of glass fitted in between



SAME WEIGHT OF HONEY IN SQUARE AND TALL SECTIONS.

the projecting sides of the section. The glass is held either by glue, tin points, or paper pasted over the top and bottom of the section, and lapping over on to the glass a little way. When the section is sold to the retailer, the glass is included in the price of the honey. Of course, the producer can afford to sell glass at from 12 to 15 cts. per lb.; but customers have sometimes objected, and justly, too. But in spite of all this, glass sections have quite a rage at times in the New York and other eastern markets, and occasionally there is some sale for them in the West.

PASTEBOARD BOXES FOR ONE-POUND SECTIONS OF COMB HONEY.

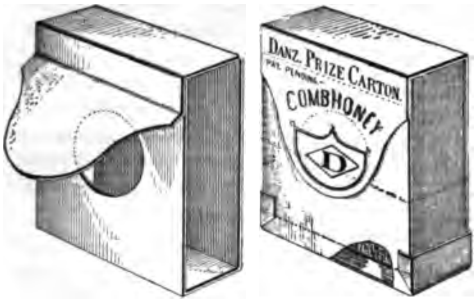
This package has a bit of "red tape" attached to it, to carry it by. It is a safe and pretty package for a single section of honey, being very convenient for the customer to carry, or pack in his valise or trunk, if he wants to. It is closed by a tuck flap, and can be quickly opened. Finely colored lithographic labels may be used on one or both sides. Their cost in the flat, without labels, is about $5.00 per 1000, and very pretty labels can be had for about $3.00.

BOX FOR CARRYING HONEY.

Mr. J. E. Crane, of Middlebury, Vt., puts nearly all of his honey into cartons. These cartons are put into unglassed shipping-cases, the latter neatly stenciled with an old-fashioned straw hive, and lettered. When I visited his place I could not but admire the beautiful appearance of his big piles of cases ready for market. The white-poplar wood contrasted very neatly with the stenciling; and the cartons, with their bright clean faces, as they appeared through the sides of the shipping-cases, added not a little to the effect.

Mr. Crane finds a market for all honey put up in this shape, and the demand is greater than he can supply, and he produces tons of honey. His neighbor, not ten miles away, Mr. A. E. Manum, puts up his in unglassed sections, in glass shipping-cases, and he finds a market for all he can produce. There are others who glass a very large part of their product, and this is likewise sold. What we

want to do is to build up a trade, and to be ready to supply what the market demands, no matter whether it be glassed, unglassed, or cartoned goods.



THE DANZY SECTION-CARTON.

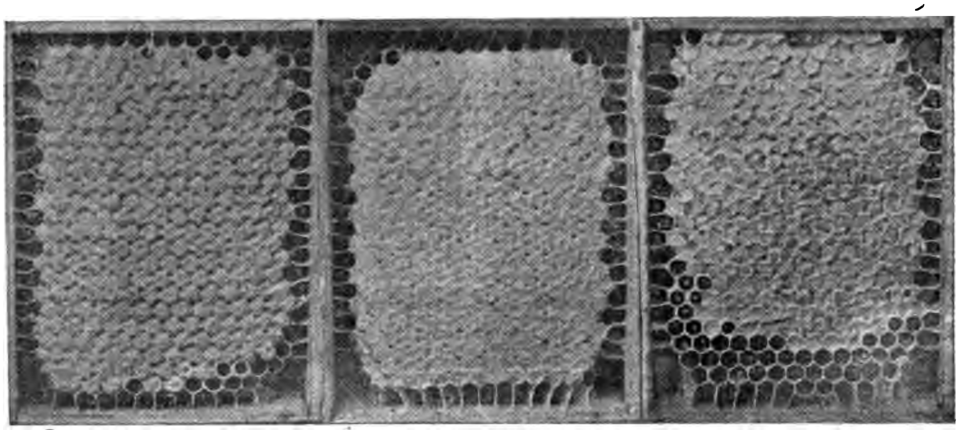
This is somewhat cheaper than the other, and answers the purpose very nicely. They are shipped folded, and all one has to do is to crowd on two opposite corners, when the package assumes a rectangular form as shown. This carton is specially adapted to use with a plain section, as will be seen from the illustration.

GRADING COMB HONEY.

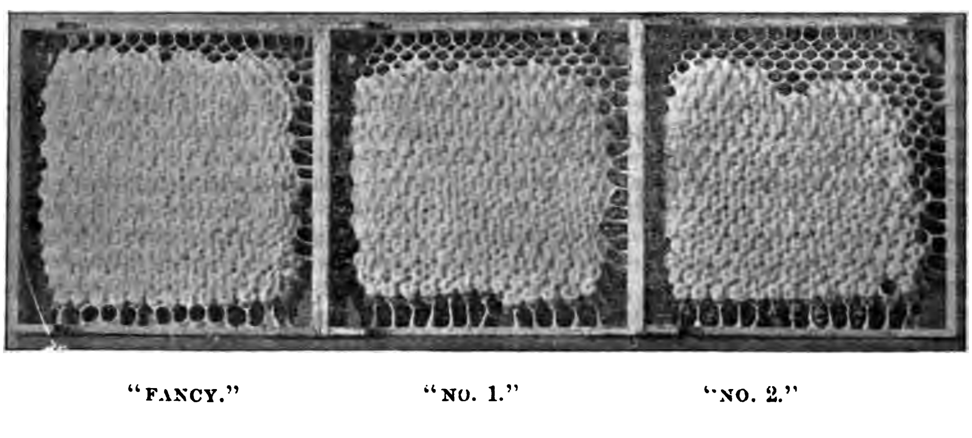
In order to get the largest price possible for comb honey, it will be necessary to grade it; and the more thoroughly and honestly it is done, the higher will be the price secured. If one is careless in grading there will be inferior sections mixed in with sections of a higher grade; and if the commission man or buyer discovers this he is likely to "knock down the price" of the whole caseful to the price of the inferior sections. It is very important to have every section in a case of the same grade.

A few years ago there was a good deal of talk about "grading-rules," and making everybody follow those rules; but it was found to be almost impossible to so arrange the wording of each grading that there

* It is well to bear in mind that the unsealed cells present a stronger contrast and look more unsightly in the engraving than in the real boxes themselves.



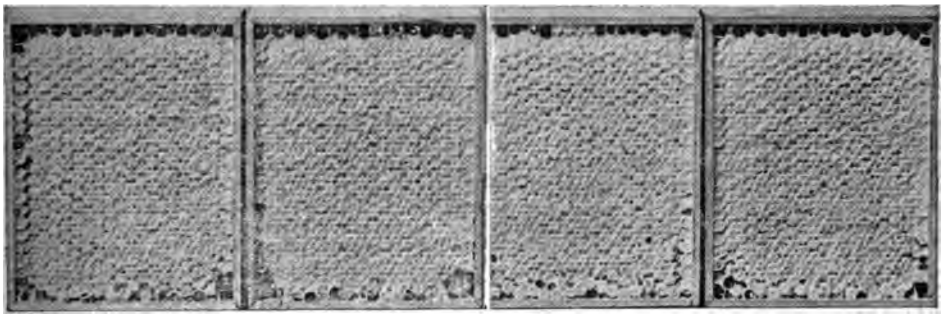
"FANCY."* "NO. 1." "NO. 2."



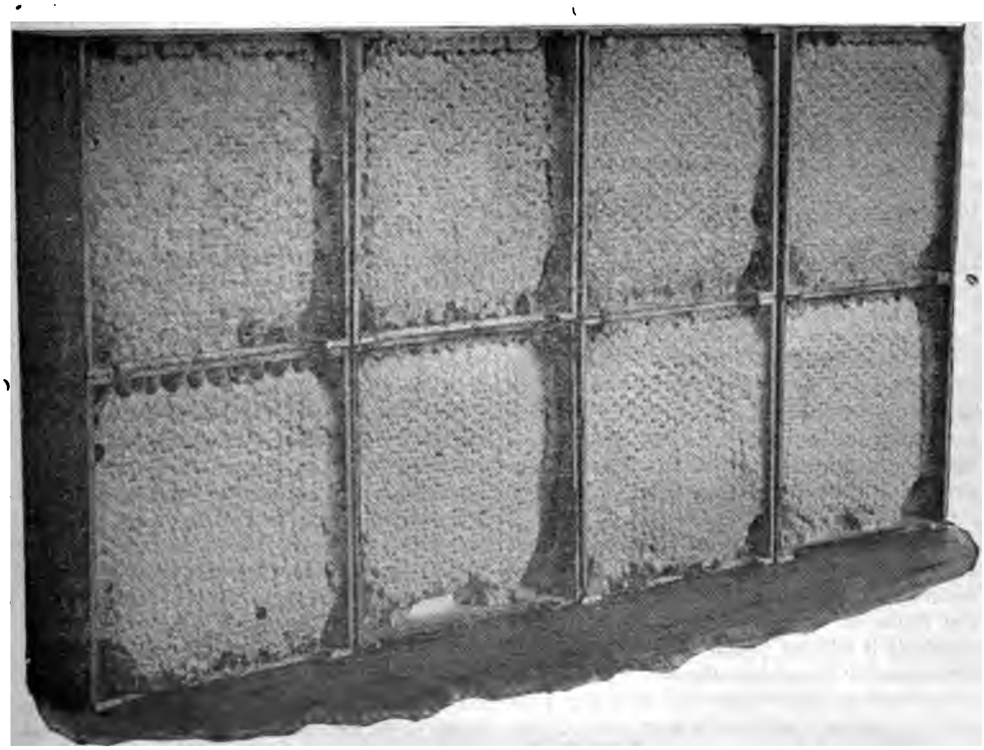
"FANCY." "NO. 1." "NO. 2."

would not be opportunity for considerable variation of judgment on the part of the grader. Accordingly it was suggested that grading be done by pictures. Mr. S. A. Niver, of New York, a honey-salesman, and one who has given this subject much thought, picked out three samples which we had photographed, and these show in the illustration showing the tall sections. But as it was claimed that there was too little difference between fancy and No. 1, another set of sections was selected and photographed, and shown below the others.

Each specimen selected as patterns should be a little *under* the average of the grade for the honey that it is intended to represent. "Then," says Mr. Niver, "if the honey sold is a little *better* than the grade calls for, there will be *no kick.*" In general the "fancy" should be well filled, and of even surface. No. 1 grade should show good even capping but not quite as good filling at the corners. No. 2, any section that is below No. 1 or in any way defective. That which is below No. 2 should be sold for chunk honey, or, better, uncapped and extracted, the



FANCY COMB HONEY IN PLAIN SECTIONS.



FANCY COMB HONEY IN BEEWAY SECTIONS.

sections to be used next year as "baits." This system of grading permits of the use of white, amber, buckwheat, and dark. For instance, there will be "fancy buckwheat," or "No. 1 amber;" "fancy dark," or "No. 2 white." The scheme on the above grading is simply this: The terms "fancy," "No. 1," "No. 2," indicate filling and evenness of comb, and condition of capping. The colors—white, amber, buckwheat, and dark—are just what the terms signify—the quality of the honey. By combining the two terms we are able to make at least twelve different grades.

This, in brief, is the grading that is adopted by the bee-keepers in New York, and, in fact, is used very largely in all regions east of the Mississippi, and even west of it to some extent. In Colorado the following grading-rules are used:

No. 1.—Sections to be well filled; honey and comb white; comb not to project beyond the wood; wood to be well cleaned; sections not to weigh less than 21 lbs. net, per case of 24 sections; but cases in lots must average 22 lbs. net.

No. 2.—Includes all amber honey not included in No. 1; to be fairly well sealed, and not to weigh less than 18 lbs. net, per case of 24 sections.

The honey shown in the next cut would be what is called "fancy white," according to the eastern grading, for it is white honey put up in plain sections, and, as the illustration shows, it is evenly and nicely filled. If the cells next to the wood were all sealed, or nearly so, it might be designated as "extra fancy;" but as such are the exception rather than the rule there will be very little "extra fancy" on the market, although such honey is generally shown at exhibitions when competing for a prize.

TRAVEL-STAINED AND OTHER SOILED SECTIONS.

There are really four classes of discolored sections, each due to a distinct and separate cause. First there is what is called the real travel-stained section. As its name indicates, the cappings are soiled because the bees have gone over the surfaces of the cappings with their dirty feet.[363]

Then there is another lot that are stained because the boxes are capped over in the vicinity of old comb, dirt, or propolis. If the faces of such sections are examined carefully it will be found that the stain or discoloration goes *clear through*. These discolorations are due to the fact that the bees take up pieces of old black wax, propolis, or any thing that will answer as a substitute or filler for pure wax. I have seen the cappings of some sections of this sort filled with bits of old rope, lint from newspapers, small hard chunks of propolis, fine slivers of wood—any thing and every thing that is right handy. Sections of this class often look like those of the first class, hence the frequent confusion.

In the third class are those with soiled cappings, due to the pollen dust or possibly a thin layer of propolis stain.

The fourth and last class takes in all those that are called "greasy" or "water-soaked," having cappings that lie on the honey. The covering to each cell is more or less transparent, or water-soaked — the transparent part being half-moon shaped, or in the form of a ring encircling a white nucleus center that is not greasy or transparent. The general surface of such sections is mottled with little transparent half-moons or circles over many of the cells.[365]

If the reader will look over the unsold odds and ends of the grocer's he will be able to find samples of all these classes, and the fall of the year is a good time to find them, as they are the last to sell.

A knowledge of how to make dark or soiled sections No. 1 white, thus bringing them at the top of the market, may be worth hundreds of dollars to some bee-keepers: and while it is probably not possible to make water-soaked and certain kinds of travel-stained sections white, there is a probability that a very large class of the soiled boxes can be rendered No. 1.

BLEACHING COMB HONEY.

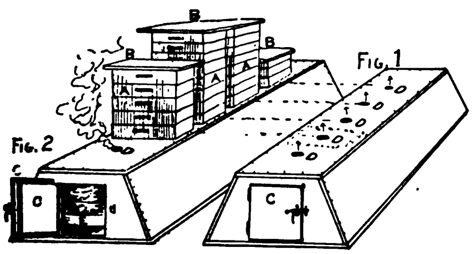
Mr. Byron Walker, a honey-merchant of Chicago, had quite accidentally placed some yellow or pollen-stained sections in his show-window, where they were subjected to the direct rays of sunlight. A short time after, he noticed that the faces of these sections that were next to the light were bleached white, while those on the reverse side retained the old color. Instantly grasping at the suggestion he placed other sections of the same kind in the same window, and was gratified to learn that these were likewise bleached as were the first; but so far as I know, Mr. Walker was successful in bleaching pollen-stained or yellow-faced combs only. The real travel-stained and water-soaked ones he considered beyond redemption. The time required to bleach the yellow sections was anywhere from two to three days, depending on the weather and the sunlight. Mr. A. E. White, of Pala, California, apparently goes one step further;

for in connection with sunlight he uses sulphur, which is known to be a powerful bleaching agent. His method of procedure is described as follows:

"**We first fumigate** with sulphur, then **place the combs** where the sun will shine **on them,** and that is the whole process.

WHITE'S BLEACHING-HOUSE FOR SOILED COMB HONEY.

"I build a frame on the south side of my **honey-house,** and cover the same with cotton cloth. A door opens from the honey-house into this room. I place shelves on the side and ends of this room, the bottom shelf being a wide board to be used as a table. I place the combs on these shelves so that the sunlight will strike them. Dark combs will require several hours. This plan will whiten dark combs here in California. If you fumigate a few combs, then place them on a window-sill where the sun will shine on them, you will be convinced.



WHITE'S SULPHUR-BOX FOR BLEACHING.

"**In placing** the sections on shelves in the **morning,** I find the following plan good: **On the** shelves at the east and west end of **the room** I place sections end to end lengthwise of the shelves, two rows on each shelf, one row on the outer and the other on the **inner edge.** The morning sun strikes one **side,** and the afternoon sun the other side. **On the front** shelves I set them crosswise of **the shelf,** far enough apart *so as not to shade each other.*

"**I pack them away every evening; all not white I put out again next morning. Some of them will bleach quite slowly, but I have been able to whiten the worst ones by perseverance.**

HOW TO MAKE THE SULPHUR-BOX.

"Perhaps your readers would like to have a handy arrangement for fumigating honey or combs. I make a box like a watering-trough, the bottom as wide as my hive is long. I place this bottom side up where I want to use it. In one end I put a door to allow me to put in an iron dish holding the sulphur. About two feet from this end I bore a two-inch hole; measure off the width of my hive, and bore holes on down the box. I place the supers over these holes; tier up, and cover the top one. If my combs are stained I sulphur thoroughly keeping them in the furnace two or three hours. If this box is placed in some building, hives filled with combs may be kept free of moths by fumigating occasionally."

Mr. J. E. Crane, of Middlebury, Vt., in carrying out this idea of bleaching honey has constructed a bleaching-room, 10 by 13, as a part of his regular honey-house. But before describing this he tells of his experiments with a cheaper form also of cotton:

I made a light frame in front of my honey-room, and covered it with sheeting, putting up shelves and selecting some 600 or 700 of my worst-stained combs. I proceeded to sulphur and bleach according to rules laid down; and after encountering some unlooked-for difficulties I succeeded in so whitening the darkest end of my crop of honey that, when sent to market, it sold for the highest market price, and was, I believe, the whitest, to look at, of any honey I sent to market that year.

I have spoken of having met with some unlooked-for difficulties in bleaching. The first was in the use of sulphur. Some say the sulphur smoke should be cold, and they use or recommend burning it some distance from the combs, and carrying it in a pipe through the ground and then setting clamps over where it comes up. I found it, in our colder climate, very difficult to get a draft through such a pipe, and at times impossible, as the pipes would be colder than the atmosphere, where the draft would be downward and not upward, and no amount of coaxing would make it do the work or go where I wanted it to.

Another difficulty I quickly ran against was the dampness of our climate, with more or less storms, when I found my lean-to of cotton cloth, as recommended by Mr. White, was far from satisfactory. At one time there was a heavy storm of rain and wind, which, flapping the wet cloth against my honey, gave some of it quite a soaking even upsetting one shelf with the honey on it. If such a structure were to be used, either the honey must be carried into a warm dry room every night, and set out again in the morning, or we must expect more or less of the combs will be injured or ruined with dampness, and the extra labor would cost all the gain in the price of the bleached honey.

Notwithstanding these difficulties I was so well pleased with results I determined to put up a [illegible] substan-

tial structure and overcome some of the difficulties referred to; so, after my work was out of the way and my bees packed for winter, I went to work and ran a wing out from my honey-house, some 10×13 feet, with gable roof, with mostly glass sides, as will be seen by the photo. There are six sets of shelves that extend completely around three sides, and will accommodate 1056 4¼×4¼ sections. I place one row of sections on top of another—or, rather, two rows of sections on each shelf, as, after some experience, one can handle two sections about as fast as one, and thus save time. I have ceiled this room overhead, with matched lumber, with a door in the ceiling at the opposite end from which I enter, with a cord attached, and extending overhead on pulleys and coming down into my honey-room. This door is for a ventilating-flue to get rid of my sulphur smoke when I fumigate or give my combs a sulphur bath. As my room is seven feet to the ceiling it consequently contains about 875 cubic feet of space. As sulphur is cheap I much prefer to burn enough to fill this room full of smoke than to take the roundabout way of burning a little and forcing it up through a few clamps of honey. With the experience of the past summer I find I can burn six ounces of sulphur at a time in the room, and let it remain for twenty minutes from the time it begins to burn till I open my door overhead, and throw open my door from my honey-room to the bleaching-room, when in two minutes the smoke will so far have left that we may enter without any trouble, and in a few moments more the room will be almost entirely free of smoke.

The most satisfactory way of burning the sulphur was to place it in an old spider and set it over a two-wick Florence oil-stove. The sulphur will soon melt, and, after a little, thicken, when a match will set it on fire, and the whole burn quickly. As soon as I set it on fire I close the room, and in twenty minutes open the door and ventilator, and the job is complete. I find that sunlight will bleach faster than the light without the sun; yet the sun through glass during the summer is so hot at times it is necessary to cover the outside of the glass during hot weather with muslin or cheese-cloth, and remove it on the approach of cool autumn weather.

The effect of sulphur smoke on combs is very interesting, and well worth some study by those interested. The effect of the smoke in bleaching combs appears to be much the same as dilute sulphuric acid on wax; and as both are somewhat alike, or composed of sulphur united with oxygen and water in a little different proportions, the one diluted with the air and the other with water, we might perhaps expect that such would be the case.

The effect of sulphur smoke in turning some combs—or, rather, some of the cappings of some combs—green while it does not affect others equally exposed is very curious. Indeed, the cappings of one comb will stand, I should say, two or three, and perhaps many times as much smoke as another. Why? I can not tell, but have observed this much: that the smoke affects those combs with the thinnest cappings first. I am inclined to think that either the sulphur or light

J. E. CRANE'S COMB-HONEY BLEACHING-HOUSE.

alone would do the work of bleaching, given time enough; but it seems evident that both working together do the work more promptly and satisfactorily.

I ran some 6500 combs the past year through the bleaching process with very satisfactory results. Combs that are only a little off would come out almost as white as snow, while those a little darker would be greatly improved. A few hundred, however, had so much propolis mixed with the cappings that no amount of bleaching would make them white, as I held some of them to it for three months, and finally concluded I might as well try to change the skin of an Ethiopian. It takes more time at best than one would expect. Even those combs that are but slightly stained usually require several days to make them look bright.

If I were building a room new for bleaching I would use glass overhead as well as at the sides, so that the combs would be exposed to sufficient light on both sides at the same time, and so save the work of turning and length of time to do the bleaching.

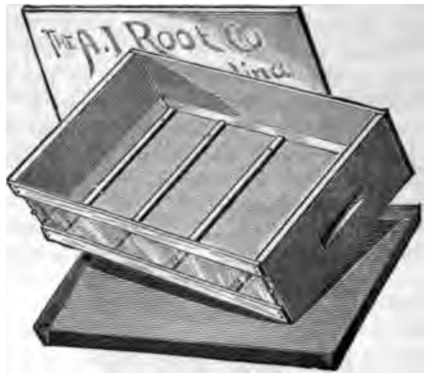
After experimenting two years he has thus proven conclusively that the bleaching of comb honey can be made very profitable. A great deal of the No. 2, or what would grade as such, can be converted, by bleaching, into No. 1; and No. 1, that would be Fancy except for color, after bleaching becomes strictly Fancy. He is thus able to add from one to two cents a pound to the value of his honey. All this bleaching he does after the regular honey season, when he has plenty of time. In the mean time his whitest and best honey is shipped to market, while the dark or discolored is later treated in the bleaching-house, and finally comes out No. 1 and Fancy, and is sold to go on the market a little later.

SHIPPING-CASES FOR COMB HONEY.

Just as soon as the crop of honey has been secured and the sections scraped, they should be put immediately into shipping-cases, provided there is no storage room that is bee-proof. The cases should be glassed on one side, in order that the fragile condition of the contents of the case when filled with comb honey may be apparent to freight-handlers, dealer, and consumer.

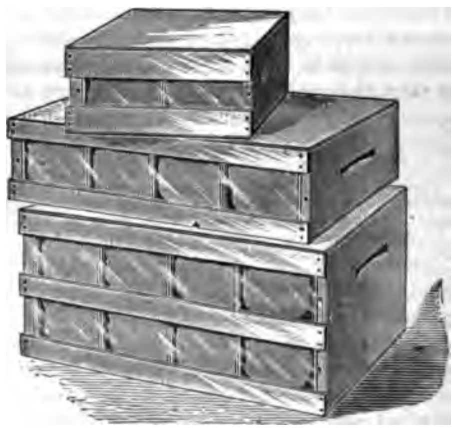
It is penny wise and pound foolish to try to make one's own cases. They will cost as much as or more than the factory-made articles, and will have an awkward and clumsy look. One prominent commission-man told me that these home-made affairs, in his market at least, "knocked the price of the honey down a cent or two" a pound.

On account of the great liability of comb honey being broken in transit, the modern shipping-case has in the bottom of it a folded paper tray, the paper used being an ordinary good grade of manilla. It is cut about 2 inches longer and wider than the inside dimensions of the case. Then with a board a little smaller than the inside dimensions it is crowded down into place, and the folds in the corners pressed flat. Across the bottom, and on top of this paper tray, are nailed



NO-DRIP SHIPPING-CASE.

strips of wood from ½ to ⅜ inch wide, and from ⅛ to ⅜ inch thick. These are spaced off in such a way as to support the sections a short distance above the paper.



THE THREE STANDARD SIZES OF SHIPPING-CASES.

The object of this is to keep the sections up high and dry, at the same time to leave room for the honey to drip, without sticking the sections to the paper tray, or, when the paper tray is not used, the bottom of the shipping-case. In that case the honey runs through, leaks on to the other shipping-cases, and, as a consequence, smears all the cases below it. Paper trays should be used by all means; and although shipping-cases cost slightly more with what we call the "no-drip cleats," the commission men and honey-buyers generally will pay enough more to make up the difference.

The standard size of shipping-case is a 24-lb. single-tier, shown in the middle of the

cut given. Then there is the 48-lb., the same thing, only double-tier, having two glass with a strip of wood between. The 48-lb. cases formerly had one large glass; but besides the fact that these were much more expensive, the honey actually shows off better when there is a strip of wood covering up the tops and bottoms of the sections, leaving only the best portion of the honey to show. Another very popular case is the 12-lb. single tier shown on the top of the pile.

12 AND 24 POUND CASES.

Some bee-keepers and some markets prefer the three-row 12-lb. and the double-tier three-row 24-lb. But these are objectionable in that they will not tier—that is, not pile up on the floor as well as the flatter cases.

MARKETING COMB HONEY.

There is nothing that can make a bee-keeper feel better than clean cash for his surplus honey at the end of the season.—*Adam Grimm, page 86, Vol. I.,* —Gleanings.

Every thing, nowadays, depends on having goods neat, clean, and in an attractive shape, to have them "go off" readily; even our hoes have to be gilt-edged, for I noticed some once at a certain hardware store, and it seemed that those that were gilt, or bronzed, perhaps, were selling far in advance of the plain steel ones. We have been told of gilt-edged butter that sold for fabulous prices, but I hardly think it will be advisable to have our honey put up in that way, although we do wish it to look as well as any other of the products of the farm.

In order to get a fair price for your honey, you should watch the markets. To obtain this information, you should take one or more bee-journals. Through the medium of these you will learn whether the honey crop is going to be small or large. This you can not tell definitely from your own locality. If you have secured a good crop of honey, and you learn that the crop throughout the country is small, you must not be in haste to dispose of yours to the first buyer. In any case you must exercise judgment.

HOW TO MAKE HONEY SELL IN THE LOCAL MARKETS.

Supply your grocer with a lot of your choicest extracted, in tumblers and bottles; and also best comb in shipping-cases. Some of it should be set off in paper cartons, and some of it should be glassed.[367] When customers come in, have in readiness strips of paper about 1½ by 2 or 3 inches. Dip one of these pieces of paper, curled in the shape of a trough, into the extracted. Twirl it around till all the drip is off, and pass it quickly to your customer, that he may sample. If he would like another taste, hand him another slip of paper, which he is to fold as nearly as possible in the form of a spoon. If the honey is ripe—that is, good and thick—your taster will want some. There is one thing that is very important. You want something to

STURWOLD S SHOW-CASE FOR HONEY.

draw a crowd. Prepare a nucleus in a glass hive, and put it up near the window where the crowd can see the bees. Sometimes the crowd will be so great as to block the street to see the queen or "king bee;" but you will be the gainer, because *your* honey is inside.

There should be on hand for a day or two an expert to explain about the honey, how it is produced, how good it is, etc., and to show that it is the most wholesome sweet in the world for children. He should then reinforce his arguments by handing out honey-

leaflets that contain cooking-recipes, and that tell why the doctors recommend honey in preference to cane sugars, or why some invalids can eat honey when they can not eat other forms of sweet. Perhaps you yourself will be the best man to do the "talking;" and therefore you had better stay with your grocer for a day or two, or at least be on hand when he is liable to have a run of customers. Charge the grocer nothing for your services, telling him that you will take your pay out of the increased sales.

If you succeed well in one market, and the novelty of the thing wears off, try another one in a neighboring town, and so on complete the circuit of the towns roundabout. After you have done all this you will not need to ship much if any to the city markets, save commissions, save freight, and have your honey within a few miles of where you can look after it, without being at the mercy of a city commission house of whose honesty you may have grave doubts. See HONEY-PEDDLING.

SENDING HONEY TO COMMISSION HOUSES.

I believe the commission houses throughout our cities are great aids to bee-keepers in disposing of their honey; notwithstanding, I want to enter a word of caution right here against being in too great haste to lump off your honey to these places. You may argue that you have not time to dispose of your product in small amounts; but many a bee-keeper has found to his sorrow the mistake he made in contributing to the flood of honey at a certain commission house. The consequence is, that at that place honey is "a glut on the market," and must be sold at a very low price. As a general rule, I believe I would sell elsewhere before shipping it off to the city.

But it very often happens that one can get a higher price by sending to these commission men. The general trade looks to them for supply, and they make it their business to find a market.

But never send honey on commission or outright sale to a new firm, no matter what it advertises, how big it talks of its financial standing, nor what promises it makes. Go to the nearest bank and find out regarding its responsibility. Then ask the commission house to send you the names of bee-keepers who have dealt with the firm. I would not advise you even then to consider this an evidence of good faith. I would take time to write to the parties and ask if their dealings were *entirely* satisfactory, and whether they would advise shipping to the commission house in question. The temptations in the commission business are very great; and if your man is not honest to the core he may take advantage of you. Commission men charge all the way from 5 to 10 per cent commission; and in addition to this the shipper is required to pay freight, drayage, and to stand all breakages.

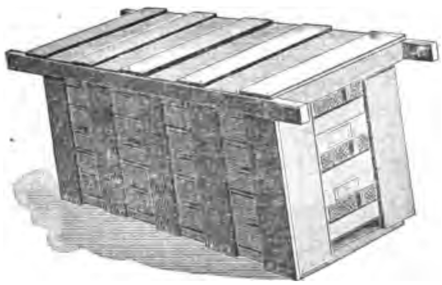
Most commission houses will make advances in cash on receiving the honey; and a few of them will make payments as fast as it is sold; but a majority make no remittance until the honey is all sold, and sometimes not even then until the bee-keeper writes complaining, and inquiring regarding his honey or his money.

I have said that commission men should be honest to the core; but some of them yield to the temptation of quoting a higher price in the bee-journals than they are actually realizing in every-day sales.[371] The bee-keeper complains when he receives his returns, and he is met with the statement that his honey was of poor quality, and had to be sold for less money; or that the honey came badly broken, and had to be lumped off as chunk honey; or he may be told that the "market suddenly fell" (which may be true), and it was not, therefore, possible for the house to realize quotations given in the bee-journals. It is a common trick on the part of dishonest commission men to quote high prices if they can get their names in the bee-journals, and then sell for lower prices in order to "move off stock." But I have had reason to believe that sometimes, from the complaints that have come in, and from certain evidence placed in my hands, honey has actually sold at several cents higher per pound than was shown by the account of sales rendered to a bee-keeper, and on which commission was based. In this way commission men practically take two commissions. Say, for instance, the honey sold for 12 cents. He makes returns to the bee-keeper of 10 cents, and then charges 10 per cent commission on this 10 cents. He thus makes the 2 cents which he actually steals, and then the 10 per cent which is rightfully his.

In the foregoing I have endeavored to set forth some of the tricks that are practiced by some of the unscrupulous commission houses. But I am glad to say that all, or nearly all, of the men who quote prices in the bee-journals are responsible and honest men; for no commission man can hold his name in the advertising columns of the average bee-journal to-day if there are com-

plaints entered by bee-keepers against him. And right in this connection I wish to say that the mere fact that your bank says a certain commission house has good financial rating should not be considered as evidence that the house is also honest. I would rather trust the man who is honest and not responsible than the one who is financially good and yet "up to the tricks of the trade."

When honey is sent in small lots, say from one to two dozen crates, I would always put it into a shipping-crate as shown in cut. The cases should be so arranged that their fragile contents will show through the glass; and when loaded on the car the combs should be parallel with the rails. Wherever possible, see to loading the honey yourself, and if you deal with an honest commission house it will have a careful drayman to take care of your honey on arrival. If honey is to be shipped in car lots, then the shipping-cases can be set down in the car on a thin matting of straw; but be careful to place the combs so they will be parallel with the rails. The cases should be packed snugly together, and the piles should not be high. If the honey is sent in a carload, make the oad as flat as possible.



SHIPPING-CRATE.

At the time you make shipment, send bill of lading to the commission house, and *name price below which the honey must not be sold.* A commission house has no right to sell at a lower figure until you give instructions. Before the honey is packed it should be carefully weighed so that you will know exactly how much honey you have sent. Do not send large shipments at first. If in any case you send honey, and the commission house fails to make returns, or refuses to do so, it is a criminal act. Such house has no right to appropriate your money without rendering to you some sort of returns; but never take a note in payment from an irresponsible firm or individual: if you do you will be powerless to help yourself; for legally a note is a settlement.

SELLING FOR CASH.

If you can sell for cash, and the party is responsible, by all means do so, providing you can get market prices. Look out for firms wanting to buy for cash with no rating. To make yourself secure send the honey to *your* name at the point of destination, and then send bill of lading to some bank in the city with instructions to turn over bill of lading to purchaser on receipt of cash. Banks will charge you a small fee for doing the business, but you will be safe. The law gives the producer greater protection when his honey is sold on commission than when sold for cash, providing money is not received before honey is turned over. I wish to reiterate the point again: Never deliver honey to a firm on an outright sale or deal till the banks say your man is entirely responsible; *then* if every thing is in writing you are able to collect by due process of law; but if he is irresponsible you will be throwing away good money in trying to do any thing with him.

KEEPING COMB HONEY.

It is sometimes desirable to keep comb honey for a better market, or that we may have a supply the year round, etc. Well, to keep it with unimpaired flavor it must not be subjected to dampness. If water condenses on the surface of the comb it soon dilutes the honey, and then it sours, etc. On this account the honey should never be put into a cellar or other damp room. Better put it upstairs; and that there may be a free circulation of air, without admitting bees or flies, the windows should be covered with painted wire cloth. We are accustomed to keeping comb honey the year round, and rarely have it deteriorate in the least. The same remarks will, in the main, apply to keeping extracted honey. During damp and rainy weather, the doors and windows to the honey-room or honey-house should be closed, and opened again when the air is dry.

Comb honey should under no circumstances be stored where it is likely to freeze, as freezing contracts the wax so as to break the combs and let the honey run. Mouse-traps should be kept set to catch the first mouse that appears.

Under EXTRACTED HONEY will be found hints on peddling honey and marketing in general. See also PEDDLING HONEY.

CONTRACTION. A few years ago contraction of the brood-nest seemed to be all the rage. It was argued that most colonies, Italians especially, after they had got

a little honey in the brood-nest, would be dis-inclined to go above into the supers; and to force them above, some bee-keepers took out three or four of the brood-frames below and contracted the brood-nest, and then placed supers on top. This was very pretty in theory, and in practice it *did* force things. It forced the bees into the supers, but more often forced swarming.

Another set of contractionists argued in favor of hiving *swarms* in a contracted brood-chamber. They did not believe in contracting the brood-nest in an established colony; and, therefore, when they contracted at all they did so during swarming time only. This form of contraction will certainly be better than the other; but as the years go by we hear less and less about contraction and more and more about expansion—how to get colonies strong—big, rousing, powerful colonies. An eight-frame brood-nest is usually small enough. Indeed, a ten-frame may be none too big. See HIVES, SIZE OF, elsewhere, for the further consideration of this subject.

CRIMSON CLOVER. See CLOVER.

CYPRIAN BEES. See ITALIANS.

"THE PROOF OF THE PUDDING IS IN THE EATING."

D.

DANDELION (*Taraxacum*). This plant, I am inclined to think, is of more importance than is generally supposed, for it comes into bloom just after fruit-blossoms; and as it yields both pollen and honey, it keeps up brood-rearing when it is of the utmost importance that it be kept going.[65 375] I do not know that it would pay to raise a field of dandelions expressly for the bees; but as they grow to a great size and luxuriance when allowed to stand and blossom in the garden, I feel pretty sure that a cultivated plat of them would furnish a great amount of honey. What a pretty sight it would be on our honey-farm! They do not ordinarily blossom until the second season, but perhaps, like catnip and clover, they would do so, if sowed early, and cultivated. As dandelions seem to be much on the increase in the fields and about the roadsides in our vicinity, I think we can safely conclude that, the more bees there are kept, the more such plants we shall have; for the bees, by fertilizing each blossom, cause them to produce an unusual amount of good sound seed. I do not think of any other purpose for which the dandelions can be used, except as greens in the spring; if we allowed stock to forage on our yellow flower-garden, I am afraid it would mar its beauty, if not its usefulness for honey.

I really can not say much in praise of the dandelion honey, for we extracted some that we called dandelion on account of the taste, and we could not use it at all. It was so dark-colored and strong that we with difficulty gave it away. The honey *may* have been from the shell-bark hickory, however, as that comes in bloom at about the same time.

DISEASES OF BEES.—A few years ago it was considered that bees were freer from disease than perhaps any other class of animated creation, for the reason than individual members of the colonies were so constantly giving way to the younger ones. But this has been shown to be, to a great extent, a mistake: for apparently there are at least seven or eight distinct diseases with which the bee-keeper has to contend; and it is well for the beginner to have an idea, at least, of what they are like: for the time to cure a disease of a contagious character is to take it at the start, or, better still, take precautionary measures such as will prevent its making even a *beginning*.

HOW TO AVOID DISEASES.

Contagious diseases spread very rapidly among bees, just as they are inclined to make rapid headway in crowded centers of the human family. Unfortunately, bees are disposed to rob from each other during a dearth of honey—see ROBBING; and if the sources of infection reside in the honey, any contagious disease may be spread over the entire apiary in a few days. An infected colony is naturally weakened and discouraged, and as a result the bees do not make the defense that they would under normal conditions. During a dearth of honey the healthy bees all over the yard are quite disposed to rob the weak or sick ones, with the result that the infection is scattered right and left.

One of the best precautions against disease is good food, and keeping all colonies strong. A healthy human being is much more able to resist the germs of infection than one who is "all run down." A person, for instance, is not likely to come down with typhoid unless his system is greatly reduced. Then it is that the typhoid germs, which may be ever present, take hold and begin their insidious work.

Another wise precaution is to keep all tools and clothing, and every thing that has been in contact with a diseased colony, away from the healthy ones. If one does not *know*

what the disease is he should be on the safe side and proceed as if the sick colony were infected with the worst infection known to bee culture.

TWO CLASSES OF DISEASES.

The diseases with which the bee-keeper has to contend may be divided into two classes — those that affect the mature flying bees, and those that attack the brood. The last named are much more serious, and their full treatment will be found under the head of Foul Brood. Among the brood diseases may be named, first, foul brood, which is one of the most serious, and more generally scattered over the country. Another disease, not so widely scattered, but perhaps equally bad, is called black brood, or the New York bee-disease. Pickled brood, much resembling the last named, is of a much milder character, but requires prompt attention. All of these brood diseases, as they have similar characteristics, are, for purposes of comparison, treated under the head of Foul Brood. There is one other form of affected brood that greatly resembles specimens of the above-named brood diseases. It can not be styled a disease, as it is simply brood that has been poisoned from the spraying-liquids administered during the time fruit-trees are in bloom. For particulars, see Fruit-trees.

Among the diseases that attack the mature bees may be named "spring dwindling." This, perhaps, could hardly be considered a disease, but it is a malady with which we have to deal. For particulars, see Wintering. Still another trouble is dysentery; and we may seriously doubt whether this also should be called a disease, unless, forsooth, we should say a boy had some disease when he has eaten some green apples. However, it deserves a special treatment, and is treated under the head of Dysentery, which see. The only disease of any account now remaining is bee-paralysis.

BEE-PARALYSIS.

This is a disease that is much more prevalent and virulent in warm than in cold climates. Almost every apiarist in the North has noticed at times perhaps one or two colonies in his apiary that would show bees affected with this disease. But it seldom spreads or makes any great trouble; but not so in the South. It is known to affect whole apiaries, and seems to be infectious. Unless a cure is effected in some way it will do almost as much damage as foul brood itself.

SYMPTOMS.

In the early stages an occasional bee will be found to be running from the entrance, with the abdomen of the bee greatly swollen, and in other respects the bee has a black, greasy appearance. While these sick bees may be scattered through the hive, they will sooner or later work their way toward the entrance, evidently desiring to rid the colony of their miserable presence. The other bees also seem to regard them as no longer necessary to the future prosperity of the colony. In fact, they will tug and pull at them about as they would at a dead bee until they succeed in getting them out in the grass, where the poor bees seem willing to go to die alone. Another symptom is, that the bees often show a shaking or trembling motion. In the earlier stages, so far as I can remember, this peculiarity does not appear; but later on it manifests itself very perceptibly.

TREATMENT AND CURE.

As yet we know of no reliable cure. In many cases destroying the queen of the infected colony, and introducing another from a healthy stock, effects a cure. This would seem to indicate that the disease is constitutional, coming from the queen; but in the South, where the disease is much more prevalent and destructive, destroying the queen seems to have but little effect. Spraying the combs with a solution of salt and water, or of carbolic acid and water, has been recommended; but, so far as I know, these do little or no good. One writer recommends removing the diseased stock from its stand, and putting in its place a strong healthy one. The diseased stock is then removed to the stand formerly occupied by the well bees. He reports that he has tried this in many cases, and found that an absolute cure followed in every instance. The *rationale* of the treatment seems to be that the bees of the ordinary colony having bee-paralysis are too much discouraged to remove the sick: as a consequence, the source of infection—that is, the swelled shiny bees—are allowed to crawl through the hive at will. But when the colonies are transposed, the healthy vigorous bees of the sound stock carry the diseased bees entirely away from the hive. The sick and the dying being removed the colony recovers. As bee-paralysis in our locality is a very mild disease, often going off of itself, we have never been in position to decide on the merits of this transposition plan.

If I had a case of bee-paralysis in my yard, I would take the colony, hive and all, and all its belongings, to an entirely new location, at least a mile or two, and *remote from any other bees.* If more cases developed in the yard I would take these also and place them along with the other diseased bees, and there establish a quarantine. I would never allow a colony that has a few bees affected with bee-paralysis in the general apiary where there were 50 or 100 healthy stocks to remain one day after discovery. It should be removed to the new location, and there experimenting can be conducted without danger of giving the disease to the healthy bees in the regular apiary.[379]

If one is of an experimental turn of mind, and wishes to try the transposition treatment, he can easily try it at the quarantine yard. Remove the sick colony or colonies to be experimented upon in this yard a few feet back or a few feet to one side of their present location, and then put in their places one or more healthy stocks from the general apiary. Of course, there will be the danger that the moved healthy bees may get the disease also; but only the bees in the quarantine will be in danger.

QUEEN CRAMPS.

These affect only the queen. Sometimes when the queen is picked up in the fingers by the wings she will curve her body to such a point as to seem to "get a hitch" in it. When in that condition she appears to be paralyzed, and almost devoid of life; but if she is placed in a queen-cage or among the bees she will recover shortly and be as lively as ever. Beginners are very often alarmed, and conclude that the queen is dead or dying; and I have even known them to throw her away, or smash her to relieve her of her suffering. All that is necessary is to let her remain for a minute or two, when she will recover of herself.

OTHER DISEASES.

It may be well to mention that, when a bee is crippled or diseased from any cause, it crawls away from the cluster, out of the hive, and rids community of its presence as speedily as possible; if bees could reason, we would call this a lesson of heroic self-sacrifice for the good of community. If your bees should get sick from some other cause than I have mentioned, I would advise putting enough together to make a good lot, surrounding them with chaff cushions close up to the cluster, and giving them plenty of sealed honey also close to the cluster. If you have not the honey, and the weather is cool or cold, use candy. If the cluster is small, give them a small piece at a time, right over the cluster, under the cushions.

Weak colonies sometimes get a mania in the spring for destroying their queens; this can hardly be termed a disease, and yet the colony has become to a certain extent demoralized, and out of its normal condition, much as when they swarm out, as given in ABSCONDING SWARMS; they will generally come out all right if fed carefully and judiciously, as we have described. Bees are always prospering when they are accumulating stores, and they are very apt to get astray, in some way or other, when they are very long without some way of making daily additions to their "stock in trade," unless it is during the winter, when they are, as a general thing, mostly at rest. Almost all sorts of irregular vagaries may be stopped by regular daily feeding, of granulated-sugar syrup, or giving combs of good white honey.

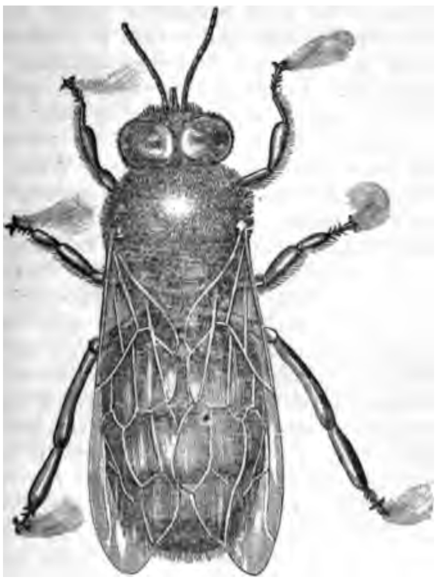
For the consideration of spring dwindling, see WINTERING. The diseases foul brood and black brood will be found under the head of FOUL BROOD.

DIVIDING. This term is usually applied to the operation of increasing the number of stocks, by putting half the bees and combs into a new hive, just about swarming time; it is really one method of artificial swarming. If you have an extra laying queen to give the queenless portion, it may do very well; but otherwise it is a wasteful way of making increase, and has been mostly abandoned. See NUCLEUS.

DRONES. These are large noisy bees that do a great amount of buzzing, but never sting anybody, for the very good reason that they have no sting. The bee-keeper who has learned to recognize them, both by sight and sound, never pays any attention to their noise, but visitors are many times sadly frightened by their loud buzzing. We will commence as we did with the worker-bees, at the egg, and see how much we can learn of these harmless and inoffensive inmates of the bee-hive.

If our colonies are prosperous, we may find eggs in the drone-comb of some of the best hives as early as March, but not, as a general thing, until April. You can tell the drone-cells from the worker at a glance (even if you have never seen them) by the size, as you will see by looking at HONEY-COMB. Whenever you see eggs in the large

cells, you may be sure they are drone-eggs. I do not mean by this that the eggs that produce drones look any different from any other eggs that the queen lays, for in looks they are precisely the same. They are almost the same in every respect, for the only difference is that the egg that produces the worker-bee has been impregnated, while the others have not; but more of this, anon. The egg, like those producing workers, remains brooded over by the bees until it is about 3 days old, and then by one of nature's wonderful transformations the egg is gone,



DRONE-BEE.

and a tiny worm appears, a mere speck in the bottom of the cell. This worm is fed as before, until it is about a week old, and is then sealed over like a worker, except that the caps to the cells are raised considerably more; in fact, they very much resemble a lot of bullets laid closely together on a board. They will begin to cut the caps of these cells in about 24 or 25 days; the caps come off in a round piece, very much like those from a queen-cell.

The body of a drone is hardly as long as that of a queen, but he is so much thicker through than either queen or worker that you will never mistake him for either. He has no baskets on his legs in which to carry pollen, and his tongue is so unsuited to the gathering of honey from flowers that he would starve to death in the midst of a clover-field.

I presume the young drones are ready to leave their hive after they are about two weeks old, and they do this shortly after noon, of a warm pleasant day. They come out with the young bees as they play, and first try their wings; but their motions are far from being graceful and easy, and they frequently tumble about so awkwardly that, as they strike against your face, you might almost think them either drunk or crazy. I do not know how we can very well decide how old a drone must be to fulfill the sole purpose of his existence, the fertilization of the queen, but should guess anywhere from three weeks to as many months.[68] Perhaps they seldom live so long as the last period named, but I think they sometimes do. Many facts seem to indicate that they, as well as the queen, fly long distances from the hive—perhaps two miles or more. We have now satisfactory evidence that the meeting between queens and drones takes place not very high up from the ground. Several observers, during the past season (1889), have reported having seen this meeting not very far from the hives, during the swarming season. The queens and drones both sally forth during the middle of the day, or afternoon, and in from fifteen minutes to an hour, or possibly a couple of hours, the queen returns with a white appendage attached to the extremity of her body, that microscopic examination shows to be the generative organs of the drone. These facts have been observed by hundreds of bee-keepers, and are well authenticated. In attempts to have queens fertilized in wire-cloth houses, I have, after letting the queens out, seen the drones pursue them until both parties vanished from my sight. Still another fact: If you take a drone in your hand some warm afternoon just as he has sallied from the hive, and press him in a certain way, he will burst open something like the popping of a grain of corn, extruding the very same organ we find attached to the queen, and dying instantly.

The manner in which the meeting of the drone and queen takes place was not witnessed until 1888.[383] A correspondent for *Gleanings in Bee Culture* described it as follows:

MATING OF THE QUEEN AND DRONE ON THE WING, AS SEEN BY AN EYE-WITNESS.

On June 21, 1888, I saw this mating take place. The queen issued from the hive, took two circles and came within five feet of my face, and was there met by a drone. They seemed to face each other, clinging by their fore legs, their bodies being perpendicular, and in this shape flew from my sight. It happened so unexpectedly that I hardly knew what was going on before it was too late to follow them.

I could have easily kept up with them. I have described this because your book says they have not been seen, only as they were whirling about each other. I saw these fasten; and as they did so they turned and came together, square up and down; and as they flew away their bodies inclined about like this /, and each bee was using its wings.

Myrtle, Pa. E. A. PRATT.

Shortly after this another correspondent reported the one thing yet unobserved; viz., the manner of separation of the queen and drone. He described it as follows:

AN EYE-WITNESS TO THE QUEEN'S SEPARATION FROM THE DRONE AFTER MATING.

I was going out to my bees one day, when two bees came whirling down in front of me and fell on to a pumpkin leaf. It proved to be a queen and drone. The drone acted as if he had been stung by a worker. He held fast to the leaf with his feet, and the queen kept whirling over and over, about as a fly would if caught in a spider's web, until she freed herself, then she flew out of sight in an instant, and the drone remained where he was on the leaf, but showed life for only about three minutes.

Onawa City, Iowa. S. R. FLETCHER.

The whole thing has now been witnessed, from beginning to end.

In the fall of 1876 I saw a swarm of black ants sporting in the sunshine. A close look showed them to be both males and females; and as pair after pair fell to the ground, I had ample opportunity of noting all circumstances. In this case the drones at first seemed paralyzed; but after the queens flew away, they revived and afterward flew away also. One point here particularly impressed me: The ants of both sexes were in such countless thousands that they must have come from all the ant-hills for, I should say, miles around; the result was, as you see, that there was hardly a possibility of insects from the same family meeting. Now, is there any other way in which the strain of blood could be so effectually crossed with that of some distant colony, as by this huge jubilee of both sexes?

Queen-ants, like queen-bees, seldom if ever come out of their homes at any other time, and, as if by some preconcerted arrangement, they meet and mix up apparently for the very purpose of effectually preventing "in-and-in breeding," as it is usually termed when applied to stock. Do queens and drone-bees meet in the same way, in vast numbers? Many circumstances seem to indicate they do, yet it, like many other things, lacks positive proof. Drones have been seen in out-of-the-way places, in larger numbers than we would think could possibly come from one hive; and many have heard their loud humming who have not seen them. The fact that a queen should become fertilized in so short a time after leaving the hive seems strange, unless it really is a fact that she is called to the swarm of drones by their loud humming, which she would instinctively recognize from a long distance. Flying among them she meets the drone face to face, falls to the ground, tears herself loose from her dead mate by whirling, and then returns to her hive, having been absent only a few minutes.

DOES THE DRONE HAVE ONLY ONE PARENT?

One of the most wonderful things about the drone, or male bee, is that it is hatched from an egg that is unimpregnated. So wonderful indeed is this that the matter was for ages disputed, and is even now, by many who have not looked into the matter and examined the evidence. What we mean by unimpregnated is, that queens that have never met the male bee at all will lay eggs, and these eggs will hatch, but they always produce drones, and never workers. Those who have had the care of poultry are well aware that the hens will lay eggs right along, if no cock is kept in the yard at all; and, if I am not mistaken, a pullet would commence and lay perhaps nearly her usual number of eggs, if she had never seen a male bird. Now, nearly the same is true with regard to the queen-bee. If she fails to meet a drone during the first 30 days of her life, she usually begins to lay eggs; but she seldom lays as many, or with the same regularity, as a fertile queen. The eggs the hen lays, if she is allowed to sit, never produce any chicks at all. The eggs laid by the queen, under the same circumstances, as I have said before, always produce drones. There is one more fact connected with the common fowl: If the male bird is put into the yard with the hen for one day only, good fertile eggs will be laid for many days, possibly a whole laying. If a Black-Spanish cock should get among a flock of white hens for only a single day, all the eggs laid for many days afterward will produce chicks with more or less black feathers on them. I give these statements from actual facts. The point I wish you to observe is, that the eggs of even the common fowl are fertilized as they are laid by the hen, or possibly a few days before. With the fowls, one meeting with the male bird suffices for the fertilization of an egg daily, for a week or more; with the queen-bee, for her whole life of three or even four years.

I do not know whether the hen has the

power of laying fertile or unfertile eggs at will, or not; perhaps not; but I do know that a queen-bee lays both fertilized and unfertilized eggs, alternating from one kind to the other in rapid succession. Skillful microscopists have carefully dissected eggs from worker-cells, and found the living spermatozoa in numbers from one to five. These living spermatozoa were precisely identical with those found in dissecting a mature drone. Again: Every egg a queen lays, passes a little sac containing a minute quantity of some fluid; the microscope shows that this fluid contains thousands of these spermatozoa. Is it not wonderful that these spermatozoa should live four years or more in this little sac, awaiting their turn to be developed into a higher life whenever they should be required to fertilize the egg that is to produce the worker-bee? Very well; now the egg that is taken from a drone-cell contains no trace of spermatozoa. Therefore it, like the egg of the common fowl, unimpregnated, should never hatch. But, my friends, it *does* hatch, and produce the drone. The first glimpse we get of the little bit of animated nature is the tiny speck alive at the bottom of the cell. Does he grow out of nothing, without parentage, at least on the paternal side? If his mother was an Italian, he is also Italian; if a black queen, he is also black. We shall have to conclude, perhaps, that he is the son of his mother, and nothing more. The egg that has never been impregnated in the usual way, must, after all, have some living germ incorporated in its make-up, and this germ must come only from the mother. The great skill and proficiency with the microscope, required to make these minute examinations, is such that but one or two have ever succeeded in exploring as far as I have mentioned, and it is somewhat like our investigations in the polar regions. Who among us will educate himself for the work and carry it along?

Drones are also hatched from eggs laid by worker-bees. These drones are usually smaller in size than those from a queen because they are generally reared in worker cells, and the question as to whether they are capable of fertilizing queens, so as to be of some value, like other drones, is one that I believe has never been decided. Some facts have been brought to light that seem to be pretty good evidence on both sides of the question; but, so far as I know, nothing very definite. I confess that I should not want to make use of them, even if they were good, for I want the strongest, healthiest, and largest drones I can get. For a further account of the mothers of these queer drones, see LAYING WORKERS.

After what I have said, you will perhaps see how clear it is that the drones are in no way affected by the fertilization of the queen; or, in other words, that all daughters of a purely fertilized Italian queen produce drones[70] absolutely pure, whether they have been fertilized by a black drone or not.

Until the invention and general adoption of foundation we had no easy way of repressing the production of drones in far greater numbers than could ever be desirable. Since the introduction of foundation, however, it is found to be quite an easy matter to make almost every cell in the hive a worker-cell. On the other hand, if we choose we can have a hive filled entirely with drone-comb, and a good queen could, I think, be induced to raise nearly, if not quite, a full quart of drones at one time. By this means we can have our drones raised from such stock as we choose, and we can save the vast amount of honey that has so long been wasted by rearing and feeding drones that we do not need. While extracting, I have found as many as several pounds of drone-larvæ in a single hive; and, to save the honey they would consume as soon as hatched, we used to shave their heads off with a very sharp knife. This is certainly rather expensive business, for it must take more than a pound of honey, to say nothing of the value of the pollen, to get up a pound of sealed brood. If all this labor and material had been utilized in the production of worker-brood, it would doubtless have been equivalent to a swarm of bees. All-worker comb would have insured this without trouble.

It is quite probable that all the drones will be raised that can usually be required, without making any special provision for them; but still, it may be a good idea to devote one hive, in an apiary of 50 or a hundred colonies, to the production of choice drones.

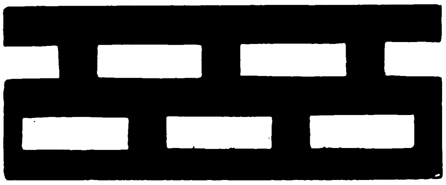
RESTRAINING UNDESIRABLE DRONES.

Drones undesirable for breeding purposes may be prevented from going out to meet the queens, by keeping them from going out of the hive, or by letting them go out into a cage through which workers can pass and they can not. This is done by taking advantage of the fact that a worker-bee will pass readily through slots in perforated metal where a drone can not. In the figure shown we give the form of the perforated metal.

Zinc is the material generally used, because it is cheap and will not rust. Some attempt was made to perforate tin as above, but it proved to be very unsatisfactory.

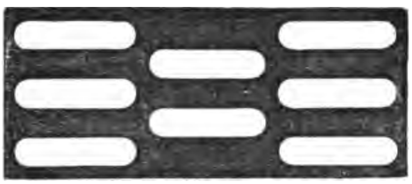
THE PROPER SIZE FOR THE PERFORATIONS.

The oblong holes, as shown above, must be of such a size as to permit the easy passage of workers, but exclude not only drones



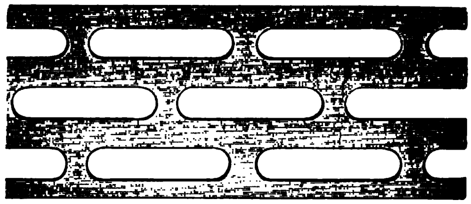
PERFORATED ZINC FOR EXCLUDING DRONES.

but even queens (see COMB HONEY and SWARMING). It is no great task to make the perforations drone-excluding; but to make them *queen*-excluding at the same time, and yet not hinder the easy passage of workers, requires a very nice adjustment in the width of the perforations. The first sheet of perforated zinc was cut in England, and imported to this country. This had perforations $\frac{18}{100}$ of an inch in width. While this answered a most excellent purpose, a few claimed that queens would occasionally get through it. To obviate this, zinc was made as below, with the perforations a little narrower.



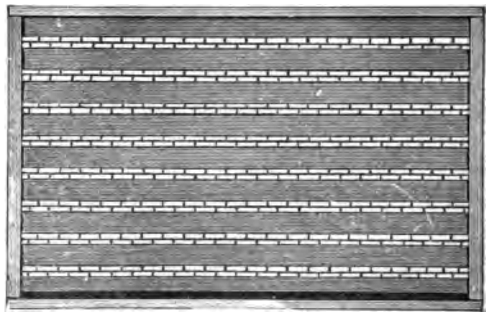
ZINC WITH SMALLER PERFORATIONS.

The width of this was $\frac{5}{32}$ or $\frac{16}{100}$ of an inch. While no queen succeeded in getting through this, reports, as well as my own experience, convinced me that this size was too narrow. It not only proved to be a great hindrance to the workers when their honey-sacs were empty, but, when gorged with honey, they were scarcely able, if at all, to pass through. More recently, perforated zinc has been made in this country on a different pattern, but with perforations exactly $\frac{165}{1000}$ of an inch in width, or a *trifle* smaller than the foreign. Perhaps, my friend, you think I am splitting hairs; but when we come to distinguish between the size of small queens and the average worker we must be *exact*. The reports, as well as our own experience in regard to the perforated zinc as so made, have led us to believe that this size of perforations is about right.



TINKER ZINC.

Zinc having perforations .165 of an inch wide is now made on the Tinker automatic machine, a machine that does more accurate work than any other hitherto constructed for the purpose. The perforations are longer, and closer together, thus affording more ventilation to square foot or square inch. It is so much better in this respect, and so much more perfect, that it is used almost

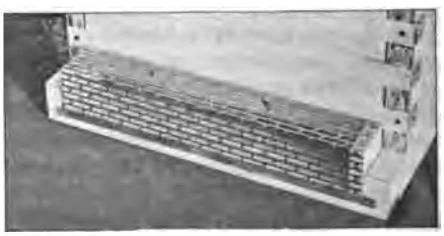


ZINC HONEY-BOARD.

exclusively for drone-guards and drone-traps, and honey-boards. In the latter we can get in longer holes, and twice as many to the board, as will be seen from the cut.

DRONE-EXCLUDING ENTRANCE-GUARDS.

If we put a strip of this material over the entrance, the worker-bees can go out, but the drones can not; but as a simple strip of zinc is liable to get clogged if there are many drones in the hive, an arrangement like the figure below is ordinarily used.



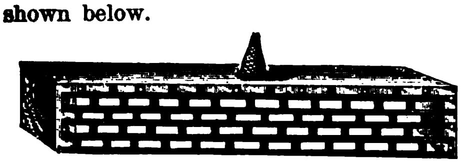
DRONE-GUARD.

This is simply a strip of perforated metal, 8¼x14 inches long, folded at right angles, as shown. Each end is then closed with a block 1⅜x1⅜x⅜, fastened in place with a couple of double-pointed tacks. To use, place tight up against the entrance as represented in the cut.

When it is desirable to get the drones *all* out of a hive without permitting any to get back again, we put the guard over the entrance and then shake all the bees in front of the hive. The workers will, of course, crawl back on the empty combs; but the drones will have to stay out, and the queen too, unless we watch for her and put her into the hive. In the morning, when the drones are stiffened with cold, they may be fed to the chickens or otherwise destroyed.

If one objects to this method as being too much trouble, he can try another way. On a sunny day a very large part of the drones will be out for a fly about 1 P. M., or a little later. He is then to place the drone-guard at the entrance; and when the drones return a little later they will be shut out. In the evening the drones may be disposed of as before.

The drone-excluder just described is not automatic. Accordingly, Mr. Henry Alley, of Wenham, Mass., has devised the one shown below.



ALLEY'S DRONE-EXCLUDER.

It is to be observed that this is similar to the one just described, only it has a wire-cloth cone in the top. The drones, after

ALLEY'S DRONE-EXCLUDER, DRONE AND QUEEN TRAP COMBINED.

making a fruitless attempt to pass the metal, will enter the wire-cloth cone in the top, and escape; but none will have sense enough to go back the way they came, but will huddle together outside and await their fate.

If it is desirable to get the drones into a box, so they may be carried to some other apiary, for instance, a cage is made with an upper story, and a couple of these wire cones conduct the drones "up stairs." If any worker-bees should go up too, they can readily go up through the perforated zinc. This latter arrangement is shown in the next cut.

As to how this trap may be used for catching swarms, see SWARMING, elsewhere.

REARING DRONES OUT OF SEASON.

This is quite a difficult matter to accomplish, especially in the spring; and although we have many times fed colonies with this end in view, we have always found some other colony that would have drones flying just as soon, without any artificial aid. Drones may be kept almost any length of time by making the colonies containing them queenless, or by putting them into queenless colonies. During warm dry weather in the summer or fall, drones may be procured by feeding, but the feeding must be regular, and given every day for several days or weeks. By feeding one colony a barrel of sugar in the fall, I succeeded in getting a nice lot of drones in October. Of course, their combs were taken away and empty ones given them, to give the queen room. Before we can get drones, we must get worker-brood under good headway, and then, if we put a drone-comb right in the center of the brood-nest, the queen will, if all things are favorable, begin at once to fill it with eggs. The feeding must be kept up, however, for bees are very easily discouraged; and if a stoppage occurs in the daily supplies, they will not hesitate to pull the young drones out of their cells and sacrifice them without mercy.

A queen will seldom produce drones until she is nearly or quite a year old, even though drone-comb may be placed in the very center of the brood-chamber.

DESTRUCTION OF DRONES IN THE FALL.

This does not necessarily occur in the fall, but may take place at any time in the summer; and I have several times known the drones killed off between apple-bloom and white clover, only because supplies ceased, causing the bees to become discouraged and give up swarming for the time being. I know of no way in which one can tell so

well that the yield of honey has ceased, as by the behavior of the bees to their drones. When, in the midst of the honey season, we see a worker buzzing along on the back of a drone who seems to be "scratching gravel" to get away from the hive, we may take warning that the yield of honey is failing, and that we had better stop making artificial swarms, and prepare for feeding, if it is our intention so to do. I do not know that I ever saw bees sting drones, but they sometimes pretend to do so; I rather think it is only a feint to drive them away. The poor drone, at such times, after vainly trying to go back into the hive, will sometimes take wing and soar away off in the air, only to return after a time to be repulsed again, until, through weakness perhaps, and want of food, he flutters hopelessly in the dust, and so submits to the fate that seems to be a part of the inexorable law of nature and of his being.

To preserve drones for late queen-rearing, I have been in the habit of carrying all frames containing drone-brood to some queenless hive, knowing they would be safe there as long as wanted, even if it were all winter. I believe drones have been, under such circumstances, wintered over; but whether they are of any value in the spring or not, I am unable to say; I should fear they would not be by the time queens could be reared. We usually have drones in some of our colonies as soon as April, and that is as early as I should care to undertake to rear queens, in ordinary seasons. I have several seasons reared queens and had them successfully fertilized, even after all the drones had been gone some time, so far as I could discover; and as they proved to be purely fertilized, I have been not a little perplexed.

DRONES WITH BRIGHTLY COLORED HEADS OF DIFFERENT COLORS.

This is a queer feature in natural history. Almost every summer some one writes or sends us specimens of drones with heads of different colors. The matter has been reported and commented on at different times in *Gleanings*. Not only do we occasionally find drones with white heads, but we find them with heads of a cherry-red color; again, of a bright green, and at other times yellow. I confess there is something very wonderful and mysterious to me in this matter. Why queer old dame Nature should decide to single out the heads of drones to sport with in this way will, it seems to me, be a pretty difficult matter to explain. Why should this peculiarity show itself in the drones more than in the queens and workers? Again, why should *heads* be the subject of these bright rainbow colors? Is there really any purpose or design in it? or is it just because it *happened* so? I presume there are very few among our readers but will say there is a purpose and a design in it; and the next thing is to decide why it should be so. Here is a question for scientists.[385]

A singular fact in regard to this matter is, that we find many of these colored drones in one hive; that is, where we find one red-headed drone in a hive, we shall probably find more; and a queen that produces them once will do so again. If I am not mistaken, I have seen hives where all the drones were colored in this strange way; and their heads were all alike — of one color.

DYSENTERY.[387] When we see our bees covering the entrances to their hives with a brownish yellow, disagreeable-smelling excrement or stain, we may say they have the dysentery, or what is usually known as such. If the weather becomes very warm and pleasant, they will usually get over it, after they have had a full flight. If, on the contrary, the symptoms show themselves before warm weather, and no opportunity is given them to fly, they may get so bad as to cover their combs with this substance, and finally die in a damp, filthy-looking mass.

CAUSE OF DYSENTERY.

I believe the most common cause is bad food, coupled with an open, cold hive, with a small or insufficient cluster of bees. I can hardly think any food alone would produce the disease, because we rarely, if ever, find the bees suffering from any thing they will gather, in warm summer weather. Honey gathered from rotten fruit, if we may call it honey, is very productive of this complaint, and cider from cider-mills is almost sure to kill bees at the approach of cold weather. I knew a lady who boiled up a mash of sweet apples and fed to the bees, because they were short of stores, and she could not afford to buy sugar for them. They all died of dysentery, long before spring. Where dampness accumulates from their breath, and settles on the combs, diluting the honey, it is very apt to cause these symptoms. Sorghum syrup has brought on a very aggravated form, and *burnt* candy or sugar is almost sure poison to bees, although it may be fed them with impunity in the middle of the summer. The burnt sugar, or caramel, attracts moisture from the air

very rapidly in damp weather, and I am inclined to think it is this moisture that produces the disease.

While it is very certain that no such symptoms are found in warm weather, it is also certain that a strong colony in a hive with soft, warm, dry, porous walls, will stand an amount of bad food that a weak one, or one exposed to drafts of cold air, will not. I have known bees having considerable stores of cider, to winter very well if the colony were strong enough to keep the whole interior of the hive dry and warm. A powerful colony, if left with their hive uncovered during a rain storm, will soon dry themselves; and while they are doing this they remind one of a sturdy cart-horse as he shakes the water off his hide and dries himself by his internal animal heat. While they have the health and numbers to repel moisture in this way, they are safe against almost any thing. But to help them to keep this internal strength, they should have close and comfortable quarters, very much such as we would need for ourselves to enable us to pass a severe winter's night in health and comfort. The hives often used are so large and barn-like, in respect to the winter's brood-nest, that comfort is almost out of the question, for it does little if any good to pile straw, corn-fodder, etc., over the outsides of the hives, while the cluster within has no sort of protection at all. If they were in a hollow tree, the diameter of which was so small that they could fill it completely, they would be in a much better place, especially if the sides were lined with soft dry rotten wood. I have seen icicles nearly as large as my arm, in box hives that were tight and large; these had all formed from the condensation of the breath of the bees. Now, should they melt during a thaw, in such a way that this water would run down on the bees and their unsealed stores, it would be very apt to produce unhealthiness, to say nothing further.

THE AGENCY OF THE APHIDES IN PRODUCING DYSENTERY.

Perhaps the most productive cause of dysentery is the honey from the aphides (see HONEY-DEW); or, at least, most complaints have been made of this honey. As bees seldom touch this, except during drouths or unfavorable seasons, it no doubt has been the cause of much of the mischief. If the early honey is all extracted from the brood-combs, and the bees left with nothing but this bad honey, gathered late in the fall, the matter is much worse; and many cases have been reported, of colonies dying where the extractor had been used, while those untouched had been free from the disease. The moral is, refrain from extracting too closely from the brood-apartment. I would at least let the bees fill their brood-chamber with clover or linden honey, just before the yield ceases, extracting toward the close of the harvest, only from the combs in the upper story, unless we choose to feed them up for winter, on sugar or candy. We have had one or two favorable reports of wintering on the aphidian honey, from which we may conclude it is not always deleterious.

PREVENTION OF DYSENTERY.

From what I have said, one will probably infer that I would make the swarm larger or the hive smaller, during the winter season. If we say, also, have the walls of the hive of some warm porous material that will absorb moisture and afterward dry out readily, we have the idea so far. Perhaps the chaff cushions and division-boards are the readiest means at our command of accomplishing this.[391]

While they might get along on almost any kind of food when thus prepared, I would by no means fail to give them good wholesome stores, as far as possible. Honey gathered in the middle of the season is generally wholesome; for by the time winter comes, it is thoroughly ripened by the same drying-out power I have spoken of. Honey gathered in the fall, if sealed up, is generally good; but some of the fall flowers produce a honey that seems to separate into a thin watery liquid, and a granular substance, something like candied honey. I am not quite sure this causes dysentery, but it looks in some seasons very much as if it does. A syrup made of white or granulated sugar, I believe, is always wholesome; and when bees are short of stores, it is probably the cheapest and safest of any thing we can feed late in the fall.

I once wintered a colony on sugar stores, that came out so healthy in the spring that they did not even spot the white snow visibly, when they voided their excrement at their first flight in the spring. This, I believe, we may consider perfect freedom from any sign of dysentery. A friend, who is an old-time box-hive bee-keeper, says it is the pollen that makes them spot the snow; that, if they are wintered without pollen, they will make no perceptible spot. I think there may be some truth in this, for those winter-

ed without pollen seem to spot the snow but little. Spotting the snow is not always an indication that we should be alarmed, especially if the bees seem to rise without trouble, and get back to the hive in safety; but should they soil the entrance and inside of their hives, and then fall around the entrance in considerable numbers, unable to take wing, it is pretty safe to say that, without very warm fine weather, they will soon be demoralized and broken up.

CURE FOR DYSENTERY.

If the affected colonies are outdoors, about the only real remedy is settled warm weather. Even one good warm day will often serve to alleviate the trouble, as it gives the bees a chance to void their excrement out in the open air, away from the hives and the combs. Otherwise the continued confinement during an extended cold spell sometimes compels the bees to retain their fæces or excreta so long that they are finally forced to void it over the combs and over the hives. In such cases, where one has good nice clean combs of sealed honey he may take out the combs and replace with the clean ones. At the same time the brood-nest should be contracted down to a space the bees can fill. But this work should never be done on a cool day—only when it is warm and balmy, as I have explained. But the practical beekeeper of to-day does not make it a rule to fuss with colonies affected with dysentery; for he knows that, as soon as warm weather comes on, the trouble will disappear of itself, in all such colonies that are not too far gone and too weak to recover.

COLONIES AFFECTED WITH DYSENTERY IN INDOOR REPOSITORIES.

After a very long cold winter, if the stores in the comb are not of the best, some of the hives in the cellar are likely to be spotted, showing unmistakable signs of dysentery. Some have recommended taking all such colonies, carrying them outdoors, and letting them have a good flight the first warm day, then taking them back to the cellar again. While, theoretically, this would seem to be good practice, yet actual experience shows it does but little good. There is very little that can be done for such colonies, unless it be to remove the combs that are badly soiled, and putting in their place combs of sealed sugar-syrup stores, for sugar syrup that is nicely ripened in the combs is surely the best food that bees can have for winter. Well-ripened white clover or basswood, or any other good quality of white honey, will do nearly as well.

As a rule I would not advise tinkering with sick colonies in the cellar. If they get to be very bad, and will surely die if left in the cellar, take them out and put them on their summer stands, no matter how cold; then put packing-cases and straw around them, protecting them as much as possible; but probably, in spite of all that one can do, all such colonies will die any way, and the only benefit that one secures is getting the bees that are soiling up the cellar, and their hives, away from the rest of the healthy bees—not that the disease is contagious, but because from the standpoint of cleanliness the cellar should be kept as clean and sweet as possible.

E.

ENEMIES OF BEES. These are, so far as I know, taking them alphabetically, ANTS, BEE-MOTHS, birds (king-birds), mice, parasites, skunks, TOADS (and frogs), and wasps. Perhaps I should also add, wicked boys or men who have so little regard for the rights and faithful hard earnings of their fellows, that they sometimes steal hives, honey and all, just for the trifling amount of honey to be got from the mashed-up ruins which they generally make of the bees and hives. It has been said, and with much justice, that ignorant bee-keepers are the bees' worst enemies. If ignorance had coupled with it willful deceit and fraud, I do not know but that I should subscribe to the assertion; but as those who have been ignoant are now very rapidly becoming educated ed and intelligent bee-keepers, I have much charity for them. The man who is persistently and willfully bad, is not only the worst enemy of bees, but of all mankind, himself included; and of this class are the greater part of those who take money for their pretended inventions in bee-hives. I am speaking severely, I am aware; but could you, year after year, hear, as I have, the statements of those who have taken up the pursuit with all honest enthusiasm, and hear them tell of how they have invested money and time, all in a wrong direction, of how they have been purposely kept in the dark in regard to what was really known about bees, of how they have been told that the bee-moth is the one great enemy, and that no one else has the secret of its banishment, I think you would agree that these land-sharks in human form are worse enemies than all the moths, birds, and toads combined, that ever infested the neighborhood of bee-hives.

Ants and bee-moths have been noticed already in their respective places.

BIRDS.

King-birds and bee-martins, and a few other insectivorous birds, prey on bees. I once saw one king-bird capture six or eight bees on as many trips, on the wing. It would alight on the peak of the barn near the apiary, and then make a dive through the air, grab one bee on the wing, return to its perch, and dispose of its morsel, and then catch another.

There have been a number of conflicting reports as to whether king-birds do or do not swallow their victims. Some have asserted that they do, and afterward expelled the ball of bees. At one experiment station a number of king-birds were shot, and the conclusion, after examining their crops, was that they did not eat bees; but from observations that have been made since it appears that the king-bird does not generally swallow worker bees. It grabs the bee, flies away, and, after it alights on some perch with its victim in its beak, bites away until it absorbs the honey or juices, when it drops the carcass, and flies away for another, which it treats in the same way. Observers have reported seeing these carcasses of bees below the birds' favorite perches: and if this be true, the reports of the experiment station above mentioned prove nothing.

The loss of a few bees which the birds might kill would amount to nothing: but in large queen-rearing yards, if the birds are allowed to go unmolested there is quite likely to be a loss of young queens: for no doubt the birds select the largest and slowest-flying bees, and these, of course, will be *queens* and drones. If such be the case, the owner of a queen-rearing yard would do well to use his shotgun until every thing in the way of king-birds and bee-martins is destroyed.

MICE.

Mice do harm only when they get into the hives, and this part of the subject will be sufficiently noticed under the head of ENTRANCES. It may be well to remark, that mice sometimes make sad havoc among surplus combs, when stored away with small patches of honey in them.[73] The combs will be completely riddled[399] during the winter time, if they are left where mice can get at them. On this account, the honey-house should be mouse-proof; and for fear that a stray one may by accident get in, it is well to keep a trap ready, baited with toasted cheese. If you have not a tight room, make it tight box, large enough to hold all the sur-

plus combs which have honey in them. See ENTRANCES.

PARASITES.

The only parasite we have ever seen is the *Braula*, or Italian bee-louse, and we have never seen them except on bees just imported from Italy. I feel safe in saying no fear may be anticipated from them, if the bees are kept in strong colonies, and in clean tight hives, with no old refuse and rubbish accumulating about them. One or two reports have been received of bee-lice in our own country, but they were exceptions.

SKUNKS.*

Skunks have been known to approach the hive at night time, and, by scratching on or near the alighting-board, to entice the bees out where they could "gobble them up." It would seem a little strange that these animals have no fear of stings, but they, doubtless, are guided by a sort of instinct that enables them to divine how to get hold of the bee with its sweet morsel of honey in its honey-sac, without receiving harm from the sting.

SPIDERS.

Spiders as well as toads seem to have a rare appreciation of a heavily laden bee as it returns to the hive; we should therefore be careful that all spider-webs be faithfully kept brushed away from the hives, and that the hives have no corners or crevices about them, to harbor such insects. Be sure there is no place which the broom will not clear out at one sweep; for where we've a hundred hives we can not well spend a great amount of time on each single one. The house-apiary is quite convenient in this respect, and it gives me a fine appetite for breakfast to go out bareheaded, and brush off every trace of a web, with such genuine good will that the poor spiders, as soon as they have recovered from their astonishment, with one accord agree that the locality is an unhealthy one for those who believe in driving a thrifty business.

I am inclined to think that many of these so-called enemies only take up the destruction of bees as a chance habit, and that it is not always to be looked for or expected. Common fowls sometimes get a habit of eating their own eggs; but it is so unusual an occurrence that we can hardly regard it as a matter of any very serious importance. It may be well, at times, to look out for the enemies that prey on bees; but, as a general thing, I think they are quite capable of fighting their own battles, if we give them the proper care and proper hives.

It was Mr. L. L. Langstroth, just before he died, who showed how spiders may be of value to the bee-keeper. If, he said, they have access freely to combs stored in stacked-up hives in the apiary, there never need be any fear that the moth-worm or moth-miller will be able to do any damage, for the spiders will very shortly destroy them.

WASPS.

Wasps and hornets sometimes capture and carry off honey-bees; but unless they should take part in the work in great numbers, I would have no solicitude in regard to them.

A large fly, called the bee-hawk, or mosquito-hawk, has been mentioned by our Southern neighbors, but it is said to be easily frightened away by opening a vigorous warfare with whips and sticks.*

THIEVES.

Thieves are sometimes troublesome at outyards, and once in a great while at home yards. The best way to put a stop to their depredations is to put up a sign or two offering fifty or a hundred dollars reward for the arrest and conviction of the guilty parties. The thief is immediately warned that a price is put upon his head, and that he had best, if he knows when he is well off, stop his stealing. It is seldom that the reward money is ever called for, and further annoyance is stopped.

ENTRANCE-GUARDS. See DRONES.

ENTRANCES TO HIVES. I do not know that it makes any *very* great difference to the bees, or with the amount of honey gathered, where the entrance is; whether at the very lowest part of the hive, or right in the top. I have had them do well with their entrance in almost all positions. On many accounts, an entrance even with, or a little below, the bottom-board of the hive would be most desirable. This gives the bees every facility for removing filth, or dead bees that frequently clog the hive and combs in cold weather, also bits of refuse comb, cappings from the cells, dust, etc., for this all falls to the bottom of the hive, and is naturally carried toward the entrance by

* A lady correspondent in *Gleanings in Bee Culture*, page 886, Vol. XV., writes that she effectually got rid of skunks by the use of Rough on Rats stirred in an egg. This mixture was placed at the entrance of hives previously visited by skunks. After the doses had been repeated two evenings in succession the skunks never again paid their visitations.

* For further particulars, and also for descriptions of *Asilus Missouriensis*, *Mallophora orcina*, *Mallophora bomboides*, and other insect-enemies of bees, see Prof. Cook's *Manual*.

the passage, out and in, of the inmates. **Also, if the upper part of** the hive is close and **warm, the warm air** generated by the **cluster, rising by its** lightness, compared with **the colder air** outdoors, has a much less **chance for escape** than if the entrance were **nearer the top of** the hive. If the entrance **is a little** below the bottom-board, cold **winds and storms** are not so readily **admitted.**

It has been said, that an entrance part way **up will not** be so liable to become clogged **with dead bees.** This I admit; but I think **it would be much** better to have no dead **bees at all** in the hive, and we seldom, if **ever, see any** in the chaff hive or in any hive **that is equally** well protected[403]. It has also **been said,** that if the bees could get in nearer the top of the hive, they would have a **short path** to the center of the brood-nest, **where** they generally make their way about **as soon as** they gain a foothold. This I admit **in part;** but if we give the bees this short **cut *in*, we also** give the warm air of the **brood-nest a short cut** *out*. Besides, with **the shallow L. frames** we use and advise, **the bees have** but a short distance to climb.

HIVE-STAND.

The illustration above shows a hive-stand **to be used in** connection with the Dovetailed **hive recommended** in this work. The **sloping front** leads directly up to the bottom-**board; and if** perchance the bees fall laden **with honey, on the** ground in front of the **entrance, they can** easily crawl up on this **slanting front into** the hive. The hive may **be set upon the** ground, but it should **be set upon four** bricks, and the grass and **weeds should be kept** mowed down away **from the entrance,** or should be cut away **entirely, leaving** a mere hard-pan of ground **leading toward** the entrance. But, all **things considered,** I recommend the hive-stand, as it keeps the hive nice and dry, and the bottom-bo[illegible] from rotting; and, what is of considera[illegible]e importance, the hive is raised up to a c[illegible]nt working distance. A hive on the g[illegible]is always harder to get at than one rai[illegible] a little.

SIZE OF ENTRANCES.

With strong colonies this is a matter of no great importance, providing the entrance is large enough to let all the bees out and in readily, in the height of the honey season, and not so large as to let in too great an amount of cold air during the severest winter weather.

DOVETAILED HIVE.

For our Dovetailed hive we recommend an entrance the full width of the hive, and 3/8 inch deep. In later years it has been discovered that, during the honey-flow, a large entrance not only prevents the bees from hanging out and loafing, but, to a considerable extent (just how much we do not know), does away with swarming. A contracted entrance causes the bees to cluster out, for the simple reason they can not keep cool enough in the hives, as those bees that hang out are simply loafers, and the loafing habit seems to encourage, even if it does not absolutely bring about, swarming. See Danzy bottom-board, under HIVE-MAKING.

BOTTOM-BOARD.

The entrances to the chaff hives are 3/8 wide, by 14 inches long[407]. If the colony is a full one, we leave them open full length all summer. If weak, contract to about one inch; and for nuclei, sometimes, so t[illegible]t just a single bee can pass. We contra

them by cutting a piece of wood 13 x 2 x $\frac{7}{8}$, and covering it with some warm thick woolen cloth.

There has been considerable controversy as to whether entrances of outdoor colonies should be contracted in winter during cold spells, and opened up again when the weather moderates. If they, in the first place, are of the old-fashioned kind, $\frac{3}{8}$ inch deep by the width of the hive, I would let them alone; but if they are of the more modern kind, $\frac{7}{8}$ by the width of the hive, it will be well to contract down during cold weather. See ENTRANCES. After making some experiments one winter we found that outdoor colonies that had an entrance, $\frac{7}{8}$ by the width of the hive, suffered greater loss of bees than those that had the same entrances contracted down. At the approach of cold weather or winter I would put in two blocks so that there would be an opening in the middle, $\frac{7}{8}$, $1\frac{1}{2}$, or 2 inches, depending on the size of the colony; and I would leave it so all winter, for I would not advise contracting or enlarging entrances to suit the winter weather. Such a practice would involve considerable labor: and if one were to forget and leave the entrances contracted clear down, when the weather moderated it would get clogged up with dead bees, resulting in death to the colonies.

If one is troubled with meadow-moles or mice in the apiary it might be advisable to contract down so that it would be $\frac{3}{8}$ or $\frac{1}{4}$ inch deep, by the width of the hive. This will not give too much ventilation at any time, but will absolutely prevent the vermin from getting into the hive.

Bees wintered in a dark cool cellar may have wire cloth tacked over the front and top to keep them from getting on the floor, if you choose, but in this case you should take them out and release them should the weather get so warm that they are impatient or uneasy. When bees are wintered on their summer stands, they are always ready for a fly whenever a warm day occurs, and are in shape to take care of themselves, under almost any circumstances, providing they have a free and unobstructed entrance.

EXTRACTED HONEY. Liquid honey, taken from the comb with the honey-extractor, has been before the world since the year 1865, and much has been the discussion, pro and con, in regard to its merits, and its desirableness compared with comb honey, for table use. If I have made no mistake, I extracted the first ton of honey ever taken from one apiary, with the extractor; and as it was put directly into market, and such honey has been kept in market constantly ever since, I have had a pretty good opportunity of knowing all about it.

If all the extracted honey put upon the market were as good as some we have raised and purchased, there would, I am quite sure, be no trouble at all in deciding that it would drive honey in the comb almost out of the question. Much has been said about adulteration, and there has been some ground for it. Glucose has been used very largely, but it can readily be detected by chemical analysis and by the taste. Pure glucose, that is, such as is used for adulterating, has a strong metallic taste that is almost nauseating. One who has once tasted the "stuff" will readily recognize proportions exceeding 25 per cent in honey. See HONEY ADULTERATION.

A really nice article of extracted honey will bring 7 or 8 cts., quicker than a poor article will bring 3 or 4; and I have seen some, aye, and have offered it for sale too, that I do not honestly think was worth over 2c., if it was worth anything at all, unless to feed bees. Is all this difference on account of the source from which it was gathered? Not at all; for all the honey we get here, in the great majority of seasons, is from clover and linden. Then where is the great difference? It is, so far as my experience goes, simply because it is taken from the hive before it is ripe. I have never seen any honey I thought was fit to extract, until it was all sealed over. Still further, I do not believe it is nearly as nice, even when it is all sealed over, as it will be if left in the hive three or four weeks *after* it has been all sealed. I will tell you some of my experience to illustrate the point.

In 1870 we extracted, from our apiary of less than 50 colonies, over 3 tons of honey. It was put up in 1-lb. bottles, and more than half was sold for 25c per pound when prices were high on extracted honey. During the fore part of the season, the honey was allowed to get pretty well capped over; but during basswood bloom, we, bees and all, got somewhat crazy, I fear, and they brought in what was but little better than sweetened water; we extracted and put it into bottles, and hurried it off to fill orders, hoping it would all get "good," as soon as the weather got cool. It candied when the weather became cool, for almost all honey will candy, or at least one portion will candy, leaving a thin watery part, which, if it

does not sour, acquires in time a disagreeable brackish flavor, like that acquired by liquids standing in an old barrel. At about this stage it shows that peculiar quality of pushing the bungs out of the barrels, and the corks out of the bottles, running over on the shelves and tables, to the discomfiture and disgust of everybody who likes to be cleanly in his habits. When I tasted some of the honey in one of these bottles, 6 months afterward, I did not wonder it had stopped selling, and I made up my mind it should no more be offered for sale. I believe it was all poured out of the bottles, and sold to a tobacconist. The contents of the jars were not all alike, for the thin watery honey has quite a tendency to swim on top. We, one season, commenced to retail from a barrel of what all pronounced fine clover honey. One day a customer returned some, saying it was not like what he bought before. We assured him it was drawn from the same barrel, and went and drew some, to convince him. Behold! it was sweetened water, compared with the first. The thin honey having risen to the top, it was the last to be drawn out.

Again, new honey has, many times, a rank, disagreeable odor and taste. I have been told that in the Eastern States much honey is sometimes obtained from the fields where onion seeds are raised for the market, and that this honey, when first gathered, is so strong of onions that it can not be used. In a few weeks, however, this rank and disagreeable flavor is all gone, and the honey is very fair. Few persons can tolerate the strong, aromatic flavor of basswood honey when first gathered, and some of the jars I have mentioned, when opened, gave one an impression that something akin to turpentine had been mixed with the honey. This was because it had been closely corked when first gathered; had it been left in the comb until sealed, the unpleasant taste would have been mostly gone. I say mostly, for even sealing does not seem to entirely remove the rank flavor, unless the combs have been some weeks in the hive. I remember I once took a beautiful-looking piece of comb honey out of a jar that was found in the market. On opening the cells I found the honey had such a rank basswood flavor, that it was, to me, quite disagreeable, and yet I am fond of the basswood flavor. Very white, new comb honey is seldom of the fine, pure, sweet flavor of honey that has been a long time capped over, such as is found in the dark-looking comb. To which shall we give the preference — looks or taste? We once were so busy that we could not attend to extracting, and so we raised the filled stories up, and put those filled with empty combs just under them over the brood. This occupied little time, and the bees were not hindered in their work a single moment. I have never seen bees amass stores faster. Some colonies filled four stories to repletion, and the whole was left on the hives until the latter part of the summer. In fact, I left them on the hives to be safe from the depredations of the moth, intending to cut out the honey and sell it in the comb, or to extract it, whichever form should prove most marketable. This honey was cut out of the frames and sold the following winter, and it was the nicest and richest honey I ever saw or tasted. To my astonishment, the liquid portions, that ran out when the combs were cut, would not candy at all, even when exposed to a zero freeze. The honey was so thick, that a saucer full could be turned over without spilling.

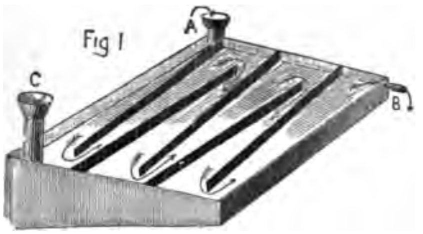
Extracted honey, if taken out while "green" (as I have often termed the unripened state), has a greenish tinge, which well-ripened honey has not.* Some specimens have a turbid, or cloudy look, and I believe such honey is never really fine-flavored. I am well aware that I am condemning the very honey I once sold, by these remarks, but I can not help it. If I had now some extracted honey such as was taken from those well-ripened combs, I would feel that it was preferable, at 10 cts., to that which sells at 5 or 6 cents. Properly ripened basswood or clover honey has a sparkling clearness, of a slightly yellowish tint, and the flavor is pure and exquisite. I have never seen any nice-looking comb honey equal to it, for the market always demands comb honey that is white, and has not remained on the hive a long time. I do not mean to say that extracted honey should be without color, like water, for it usually has an amber tint, or it may be quite yellow; but it should be clear, so that you can read print, without trouble, through a jar of it. After it has candied, if it does candy, it should be hard, and free from any liquid portion, like that in unripened honey. This thin liquid portion is the part that usually changes and gives it the bad taste. In fact, if the liquid portion be drained off, the solid portion may be melt-

* Pure cleome honey is an exception. When ripe I am told it has a "decidedly green tinge."

ed, and it will be found very nearly like that ripened in the hive.

RIPENING HONEY BY ARTIFICIAL MEANS.

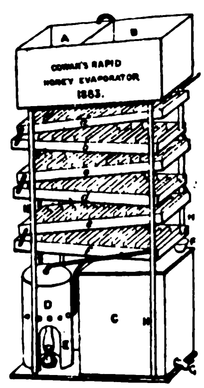
At several different periods, machines have been suggested for evaporating thin honey without the aid of the bees. The advantage to be gained in so doing is, that a much larger quantity may be obtained by taking it from the hive every day as fast as it is gathered; or, at least, the votaries of these evaporating machines claim as much. The one shown below is used by L. C. Root, of Stamford, Ct.



APPARATUS FOR EVAPORATING THIN HONEY.

It is a simple apparatus made of tin, with an inclined top. Upon the top surface are strips of tin made so as to guide the honey down the inclined strips, as shown by the arrows. Of course, the honey is to be extracted before it is capped, or just as fast as the bees collect it. In its unripe condition it is run over the evaporator, entering at the tube A, and running out at B, fully ripened. The tube C is to fill the tank with water. A thermometer is also placed in this tube, to indicate the temperature. The heat is maintained by an oil-stove.

The accompanying apparatus is the invention of Mr. Thomas William Cowan, of London, England. The 6 trays, *a*, *b*, *c*, *d*, *e*, *f*, with transverse partitions, have a double bottom, with an inch space between each, for the passage of hot water. Each tray is connected by a pipe. D is a boiler heated by a lamp or gas-jet. The hot water passes from the boiler successively through each of the trays until it overflows into the compartment A, from which the water is conveyed again to the boiler. The "green" honey is put into B. From here it passes to the upper end of tray *a*, back and forth through the partitions, until it reaches the lower end, whence it discharges into *b*, and so on to the funnel F, and finally into the tank C. The honey travels a distance of 100 feet over a heated surface, and by this time has the proper thickness. Mr. Cowan considers honey so ripened just as good as that ripened by the bees.



Mr. W. S. Hart, of Hawks Park, Fla., ripens his honey artificially by means of sun heat. He has a large pan made that has upright partitions passing backward and forward (the same as in L. C. Root's evaporator) in such a way that the honey has to pass a good many feet under glass under a tropical sun, before it finally runs into a barrel. This method, Mr. Hart says, gives him beautiful thick rich honey, and I have no doubt the solar heat might be utilized to good advantage in California, and perhaps in our Northern States, in ripening honey artificially.

So far as I know, none of these machines are in practical use, either on a large or small scale. The most that is done in the way of evaporating honey that is not entirely ripe is to put it in large tanks, covering the top with a semi-porous cloth tightly tied down over the edge of the can to prevent robber bees from getting in. In California these tanks hold anywhere from 20 to 30 tons. In some cases the tanks are contracted toward the top, leaving an opening of about 18x24 inches. In other cases the tank has a large diameter of about 8 feet, and only 4 feet high. This presents a large surface of honey, and the evaporation, therefore, would go on more rapidly. These great honey-reservoirs are usually set down outdoors, and covered as I have explained. As it seldom or never rains in California during the dry season the honey will evaporate down to a good thick body, even if it was a little green when taken out.

Whether such evaporated honey is equal to that which has been evaporated entirely in the hives, I have my doubts. I have sampled both kinds, not knowing which was which, and I believe that in every case I have been able to tell the natural from the evaporated article; but the difference is so infinitesimally small that no one but a beekeeper with an educated taste would ever detect it. Certainly the consumer would buy one just as soon as the other.

HOW TO KEEP EXTRACTED HONEY.

If the crop has been secured early it is best to dispose of it at once, when the market is

at the highest; but it is sometimes advisable to hold the honey until the price goes up, which it is likely to do after the berry season is over, when every one is thinking of the holidays, Christmas and New Year's; for it is then that honey comes into fresh demand again, and the market becomes firmer.

Extracted, or comb honey either, for that matter, should be kept in a room about as near summer temperature as possible. The mercury should not get below 65, and it may go as much higher as ordinary summer weather will permit—even 90 or 100 in the shade. Extracted, if kept, should be stored in large tin cans, or, better still, one very large one capable of holding eight or ten barrels, if the apiarist is so extensively engaged in bee-keeping that he is likely to have that amount of honey on hand at one time. Where the cans hold more than 500 lbs., it is customary to have them made of galvanized iron; and while some objection has been made to this metal because of its alleged poisonous nature, yet in the large-sized cans no injury to the honey has ever been noted: for it is the custom in California, Arizona, Colorado, and other States of the West, where large quantities of extracted honey are produced, to have the honey stored in large galvanized storage-tanks, some of them practically good-sized cisterns above ground. In those hot climates the honey will remain liquid for some time, and can be kept perfectly clear until cool or cold weather comes on. If the honey has a tendency to granulate very soon after extracting, it would not be advisable to have it stored for any great length of time in these large tanks. It should be drawn off in the marketing tin pails I have described under CANDIED HONEY, and allowed to candy hard. It may be kept in this condition for a year or two, without detriment: and whenever it is used it may be liquefied by the directions that go with the package.

Ordinarily I would not advise the storage of honey for any considerable time in barrels: but when no other storage room is admissible, barrels may be used, but they should be watched to see that they do not start to leaking in the honey-room: and occasionally the hoops should be driven down to compensate for the slight shrinkage that may take place; for it is a fact that the staves of barrels, even when filled with honey, will shrink somewhat in dry hot rooms, with the result that there will be a leakage, and possibly robbing on the part of the bees. See BARRELS.

VARIOUS PACKAGES FOR SHIPPING AND SELLING EXTRACTED HONEY.

The variety, style, and kind of packages that have been used for putting up extracted honey for retail purposes are almost unlimited. It is the usual rule that, for any thing less than 3 lbs. capacity, glass should be used; for any thing larger, tin cans or pails. Perhaps the most popular glass package is the Mason jars already spoken of. They are popular because they can be bought at any grocery, and no one objects to buying them with the honey, because they are always a useful article in domestic economy.

Another package used very largely is the Muth bottles that are made especially for holding honey. Molded right into the glass itself is the image of an old straw bee-hive and the words "Pure Honey." These bottles are square in shape, and are nice for shipping and for retailing small quantities.

The smallest size is especially adapted for holding a dime's worth of honey, and, all in all, it is a very pretty size.

GLASS HONEY-JAR, PAIL, AND TUMBLER.

Another package much used is the jelly-tumbler, and this, like the Mason jar, has the advantage that it is a useful article in the house.

With each one there is usually a little circular piece of paraffined paper. After the tumbler is filled with honey the paper is placed on top, after which the tin cap is crowded down over the whole, making an almost hermetical sealing.

Another favorite package, especially for display purposes, is what is known as the No. 25 jar. It is self-sealing, something on the order of the Mason can. It is handsome in appearance and cheap in price. These are used very largely.

HOW THE NO. 25 JAR IS PACKED.

But one who does a large business in putting up honey in glass should not confine himself strictly to one size or kind of package. For purposes of display at groceries he should have an assortment of Muth bottles, Mason jars, jelly-tumblers, and some of the No. 25. An assortment of these can be very tastily arranged in the grocery show-window. Sometimes a little honey-stand may be used to advantage. The one shown below is the one that was used by

WILLIAMS' STAND FOR SELLING EXTRACTED HONEY.

George F. Williams, of New Philadelphia, Ohio. So much for glass packages. See HONEY PEDDLING.

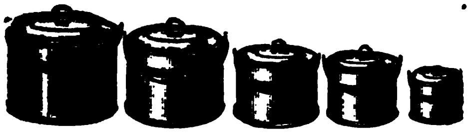
TIN PACKAGES FOR HONEY.

While cans holding $\frac{1}{8}$, $\frac{1}{4}$, $\frac{1}{2}$, 1, or up to 5 lbs., have been used for holding honey they are not nearly as desirable as glass. Crystal-white honey itself is beautiful, and to conceal it from sight by tin and a fancy label is a mistake. The purchaser of a small quantity requires to see what he is buying; and when the tin package and the glass package of equal size are put side by side on the counter, it is the universal experience that

SLOPING-SIDE PAIL.

tin should not be used for quantities less than 5 lbs., to say the least. Above this size lard-pails and nested pails are used. The former have sloping sides and can be nested together in so small a compass that 100 $7\frac{1}{2}$-lb. size can be put in a barrel; but such pails are not adapted to shipping extracted honey unless it is candied. See CANDIED HONEY. They will do very well

for retailing around and at local groceries. The same is true of the nested pails below.



A NEST OF FIVE RAISED-COVER PAILS.

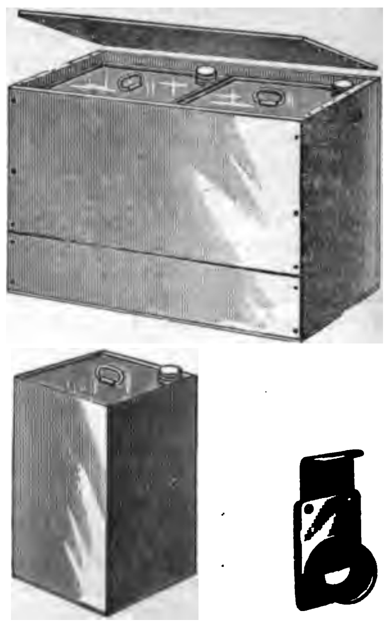
The smallest holds a pint, and the largest one four quarts. One reason, perhaps, why these pails are sold for the purpose in such enormous quantities is, that they are of just such sizes as to be extremely convenient for household purposes. The pails shown above are short, so as to be handy for a little girl's or boy's dinner-pail, or other like purposes. Such a pail does not give the greatest economy of tin, however, nor is it suited for a graduated measure like those shown below.

THE GRADUATED TIN PAILS.

The picture explains the great point in their favor; that is, that they will measure accurately any liquid, going down to as small a quantity as half a pint, and as large a quantity as a gallon, where one has a complete nest. Of course, suitable labels are to be used for these pails when they are full of honey; and, furthermore, none of these pails can be turned upside down without leakage, unless, indeed, the honey be candied so solid that it will not run in cold weather, as is often the case with a well-ripened article. These packages are used principally by retailers who purchase their honey by the barrel, and put it into pails about as fast as their customers want it. They are to be carried about, however, rather than to be shipped long distances.

For large quantities of from 200 to 500 lbs., kegs and barrels may be used. Some insist that the inside of wooden packages should be coated with paraffine, as explained under BARRELS. Others assert that this is useless and unnecessary; but if barrels and kegs are not tight *without* paraffining or waxing, they are not fit to hold honey. But wooden packages can be used only in the Eastern or Middle States. In the Western States, especially Arizona, Colorado, New Mexico, and California, square tin cans holding about 60 lbs. of honey are about the only shipping-package that can be used; for the dryness of the climate will cause the wooden packages to shrink so as to be entirely useless with any kind of treatment.

The square tin cans of the West have come to be so popular that they are now, to some extent, displacing barrels in the East; for the wooden packages have a fashion of leaking, and running out on the bottom of the car, causing commission men and honey-merchants no end of trouble; and there is danger that the wood will give the honey a taint. If the tin packages are tight in the first place, they will always be tight; and no degree of dryness will in the least affect them; and while they are somewhat more expensive per pound of honey, yet this disadvantage is offset by the convenience in retailing or wholesaling any amount less than 100 lbs. If a honey-merchant buys a carload of extracted honey in square cans he can parcel it out in 60-lb. or 120-lb. or 1000-lb. lots, just as he likes, without breaking or opening a package.



THE 60-POUND HONEY-CAN.

There is still another point in favor of the square cans; namely, there is never any loss of honey by its soaking into the package. In the case of barrels or kegs, the loss of honey absorbed into the wood sometimes runs up to two and even five per cent of the

total amount of honey, and this is considerable. When it is borne in mind that wooden packages must be bone-dry, and well coopered, one can see that a large amount of honey might soak into the pores of the wood. This, of course, can be overcome by paraffining inside; but that involves considerable labor.

Of course, the square cans have to be boxed—usually two in a box—as shown in **the illustration.** They are sometimes boxed **separately.**

A honey-gate is shown in an enlarged view at the right, below the large cut. It is made of a piece of stout charcoal tin, 2¼ x 3 inches. A piece of heavy leather is fastened by four rivets to this tin. The leather is 2 x 3 inches, so that we have ½ inch of the tin projecting on two sides. Fold this tin which projects, in such a way as to take in the tin slide, as shown in the cut. With a tinner's punch, cut a hole through the leather and tin. In like manner make a hole through the screw cap, and solder to the tin, as shown in the cut. This gives us a honey-gate that will fit on any of our square honey-cans, so the grocer need have but one honey-gate, which he can attach to his square cans as fast as he retails from them. These gates should not cost over 15 cts. each.

Square cans are used exclusively for sending gasoline and coal oil to the Pacific coast. After they are emptied they are sold for about half what new ones cost, and in many cases bee-keepers have used them, almost ruining their honey. Some of the more careful ones have washed them out. The one who has succeeded the best, and claims **that second-hand cans are exactly as good when so treated, at about half the cost, is Mr. S. S. Butler, of Los Gatos, Cal. He writes:**

I melt off the four faucets by setting four cans, with the corners that have the faucets, together, putting a shovel of hot coals on them. A good worker can clean about 100 in a day by putting in a handful of unslacked lime in each, with 3 or 4 quarts of boiling water. After it is slacked, rinse it well, and afterward rinse out twice with cold water, washing them twice with lime. In that way it will clean them perfectly.

ONE-GA[illegible] 12-LB. SQU[illegible] CAN.

More recently, to meet the wants for a smaller package on the same plan, manufacturers have introduced a 1, ½, and ¼ gallon **capacity square can with of 12, 6, and 3 lbs. of honey, shown** in the accompanying cut. The gallons are put up in boxes of ten each, and are sold at $1.50 per box, or $12.00 per hundred without boxing. In many cases it may be desirable for the dealer to order apart of his extracted honey in the 60-lb. square cans and kegs, and a part in the 12-lb. square cans, so that he can distribute to his customers according as they want a large or small package of liquid honey.

BOTTLING HONEY.

Under BARRELS I have given some general directions on how to put up the honey in wood so that it may be sent to market. But right here we will devote a little space to telling how to put it up in glass so it will not candy. Under CANDIED HONEY I have already given some general directions; but here I wish to give some details which, while insignificant of themselves, yet, taken collectively, are sufficiently important to make all the difference between success and failure. One who can bottle honey and put it up in neat and attractive form so it will not candy for at least a year can get good prices and do a first-class business.

A steam-pipe from a boiler is by all odds the most convenient of any thing for heating that we can employ; but as the average reader of this book probably can not get steam he must employ something else. While the ordinary cooking-range or cook-stove, using either coal or wood, may be used for heating honey preparatory to bottling, a gasoline-stove with three burners is far better — better because the heat *can be perfectly controlled.* A wood or coal fire is liable to burn too strongly at one time or go down at another. If the honey be overheated it will ruin it — that is, it will have been scorched or the flavor so impaired that it will sell at a moderate price; in fact, it will be absolutely unfit for bottling, and would, therefore, have to be barreled up and sold at a low price to the large baking concerns who can use an inferior or off grade of honey. Then I will say that, on account of the danger from overheating from a coal or wood stove, *use a gasoline-stove by all means* if you can not get steam.

There are two methods in vogue for heating honey to be put in glass. One is, to draw it off from a large can, while cold, into cans or tumblers, and heat while in the bottles. The other is, to h[illegible] the honey in bulk, all at once, in the [illegible]-tank. Draw it off into the bot[illegible] w[illegible] [illegible]ot, and then seal. Much will [illegible] [illegible]nditions and

circumstances as to which would be the better plan to adopt. Several of those who do a large business prefer to heat it in bulk in large receptacles, run it into the bottles while hot, and seal.

In the accompanying cut Mr. Chalon Fowls makes use of a gasoline-stove already referred to, and puts a couple of large cans on each of the top burners. These are partially filled with water, then a square can of honey is let down in each until it is completely submerged. After the honey is all melted, a thermometer is let down as will be seen; and when the mercury rises to about 160 (not higher than 180), the honey is drawn off by means of a siphon into a filling tank that stands on a lower step of the stove. This siphon may be of glass, as shown in the illustration, or it may be of common rubber tubing, such as can be obtained at the drug-store. The latter is to be preferred because it is more convenient to handle. While the honey is hot the tubing should be let down entirely into the honey until it is filled. To

MR. FOWLS; HIS MELTING-TANKS, SIPHON, AND GASOLINE-STOVE.

This represents the method of heating honey in bulk. Two large tin cans are put on the gasoline-stove, one on each burner and one on the lower burner, called the filling-tank. The upper large cans are filled about a third full of hot water. A square can of honey is inserted in each can. When the honey is melted it is drawn off by means of a glass siphon, shown, into the filling-tank below. From this tank the honey is drawn off into glass jars, and sealed while hot. This method is used by Mr. Chalon Fowls, of Oberlin, Ohio.

do this, attach a string at both ends and submerge it in the honey. Draw out one end and run it over into the filling-tank, which is lower down. The hot honey will now immediately run out; and as the can is emptied the water surrounding the can should be drawn off or else the can will float and tip over. From the filling-tank the honey is drawn off while hot, or about as near 160 as possible, into the honey-tumblers, Mason jars, Muth jars, or any of the packages described further on. As soon as filled they should be sealed while hot; after which, as soon as they are sponged off in warm water, they may be labeled, when they are ready for market.

This is, in brief, the plan followed in bottling when the honey is *heated in bulk*. Now for the other plan, and the one we shall recommend as being simpler, and the safer one for the average person to use. Indeed, it is the one we use exclusively in our own bottling business; and we send out a good many thousand packages every season.

We aim, in the first place, to make a blend of honey which we can duplicate from year to year. It is not practical, in our locality, to get a strictly pure clover or strictly pure basswood some seasons. As a rule, much of our honey is a mixed clover and basswood; but sometimes both are scarce, and we can "piece out" a crop by mixing a fine grade of alfalfa or sage. For our own trade we make a blend of several of the best grades of honey, and always send out that formula. The result is, the trade gets educated to it, is satisfied with it, and the taste remains practically the same from year to year. But if one were to put out one year a practically pure clover and another year a basswood, and still another, when neither was to be obtained, a sage or alfalfa, he would get complaints at once that his honey was adulterated, because "the last lot did not taste like the first."

Having determined on the blend, pour the proper quantity of each honey to be bottled into a large tin can, and mix. This receiving-tank should hold not less than 200 lbs, and, better, 500 lbs., and should have a quick-closing honey-gate. In the absence of any thing better, an extractor-can with the baskets and the cross-arm removed serves a very excellent purpose. Directly under the gate there should be a tray or pan on a lower shelf. Here the bottles are filled, and any dripping is caught on the pan.

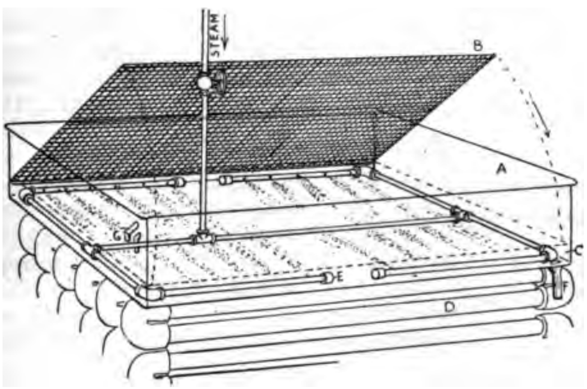
Now, then, we are ready for the bottling. We must understand that the honey in this large can is cold. If, however, it can be

BOTTLING HONEY AS PRACTICED BY THE AUTHORS.

The method already described is shown in the illustration above. Boy A draws the honey cold from a large honey-tank into the bottles, which are then put into the tray on the gasoline stove uncorked, and allowed to stand in the hot water until the honey in the jars has reached the right temperature. B then picks the bottles out one by one, and hands them over to C, who simply picks up the corks and inserts them about an eighth of an inch into the mouths of the bottles. They are next passed on to D, who forces the corks into the jars so that the top of the cork is about an eighth of an inch below the top of the mouth of the bottle. A larger view of the same thing is shown in the next illustration. The lever D has a cleat nailed across one end. On each side are nailed corks of different sizes. By turning the lever one way or the other, and inserting in one of the notches, different heights can be secured for different heights of bottles. The pressure on lever K forces the cork into the mouth of the bottle. D next passes the bottles on to E, who pours paraffine over the tops, filling up the space so it will be flush. Remember the corks were inserted below the mouth of the bottle about 1/8 inch. The paraffine is kept hot on a little lamp stove. E then passes the bottle on to the next one, who puts on the labels. The large heating-tray, as will be seen, is on a gasoline-stove. The tray is made of galvanized iron, and each has T-tins running transversely across the bottom to support the coarse-mesh wire cloth. On this are placed the bottles while being heated.

stood near the stove or a coil of pipes, all the better, for honey will run freer when it is warm.

We now need a square or oblong galvanized-iron pan as large as the whole top of the stove, with perpendicular sides, and about six or seven inches deep. If a gasoline-stove is used, the pan should be as long and as broad as the top; and if the three burners are on the same level, all the better. The pan should be just about the depth of an ordinary Mason jar; or, rather, the depth of the deepest package to be used for bottling purposes. A false bottom of coarse wire cloth should be secured about half an inch above the bottom proper by means of proper stays. This is for the purpose of providing a circulation a water under the bottoms of the bottles of honey, for otherwise



HEATING-TRAY AS USED AT THE ROOT CO.'S FACTORY.

Instead of using a gasoline-stove to heat the water in the tray we use ⅜-inch steam-pipes connected as in the manner shown. The outside pipes are perforated with holes that blow a jet of steam transversely across the bottom of the pan. The wire cloth rests on the pipes. The coil of steam-pipes below serves no purpose but to keep the large filling-tank of honey warm.

they might break. Fill the pan about half full of water, and set it on the stove. When the water registers about 180 according to the thermometer, set into the tray, on the false bottom of wire cloth, the bottles of honey that have just been filled from the large filling tank above referred to. When the pan is full of bottles placed close together, the water should be raised to within about an inch of the top of the bottles. Let them stand in the hot water until the honey in one of the bottles registers about 160. They may now be taken out and corked or sealed. A fresh supply of filled bottles of honey should next be put back to replace the first lot, and the operation of heating and sealing can be continued indefinitely. Two persons, by following out this plan, can put up something like a thousand Muth jars in a day. But why do we prefer this plan of heating honey to that of heating it in bulk? For these reasons:

1. One can fill a small order at any time; and it is not necessary to heat a great bulk of honey in order to put up a dozen bottles or so of honey. In heating a large quantity of honey, one necessarily has to keep it hot a great length of time. The longer the honey is kept hot the greater the liability to discolor and impair its flavor.

2. Bottles that are submerged in hot water can be easily wiped off with a cloth; and as soon as they are corked or sealed they are ready for labeling.

3. The honey that has been poured into the vessels, either cold or hot, will have collected a large number of air-bubbles; and it is these particles of air that have a tendency to hasten granulation. When the honey is heated gradually in the bottles after filling, the process expels the air-bubbles; and by the time the honey is clear it is ready for sealing and labeling.

4. If any honey should candy on your hands, unseal, and set the bottles in the tray of hot water, and reheat and seal without emptying. When the honey has to be heated in bulk the bottles have to be emptied and washed, which is not an easy job with candied honey, and, after heating, refilled.

WASHING AND CLEANING BOTTLES.

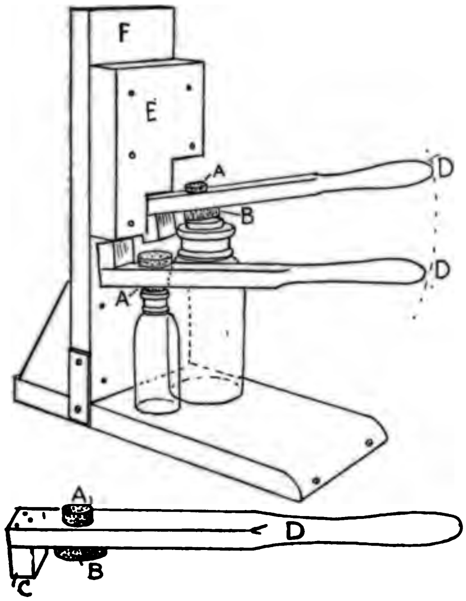
Prepare several tubs of water — one with strong suds — and then have on hand a few ounces of shot — No. 6 is about right. If particles of glass or dirt cling to the inside of the bottles, pour in four or five ounces of shot and give the bottle a shaking. This will dislodge all particles, when the shot may be poured into another bottle, to be similarly treated. In rinsing, use clear soft water. Hard wa- is liable to leave traces of sediment. Any glass package used for honey designed for table purposes should be spotlessly clean.

HOW TO INSERT CORKS IN BOTTLES.

Two or three methods are employed. One is, to use a rubber mallet, which can be purchased at any of the rubber-stores. The ends of the mallet being soft, a cork that

barely entered can be driven into the bottle with a blow.

Another plan is to use a lever, as shown at D, in cut. This lever should have a projection on the under side so the cork can be forced down into the bottle about a sixteenth of an inch. It is important, after corking,



to pour a layer of paraffine or wax over the top of the cork. Some go so far as to dip the corks into hot paraffine, then pour a hot layer on top after they are inserted in the bottles. Nay, some go even further. After the corks have been paraffined they put on a neat tinfoil top. If the honey has been heated above 160, and sealed while hot, and the cork is made impervious, the honey will remain liquid for months. I have seen samples of honey put up in Muth jars that have been kept in a refrigerator six months, and yet it would remain perfectly clear all the time. But do not advise your grocer customers to put honey in a cold place. The bottles should not be handled more than is necessary, but should be kept in a warm place at as uniform a temperature as possible.

I assume that no directions are necessary for sealing packages using rubber rings. I would only say this: That you must be sure you make the sealing as tight as possible. In the case of Mason jars, screw the tops down with a wrench, and *screw them down tight.*

In sealing jelly-tumblers, cut squares of paper (preferably paraffined paper) about the size of the top of the tumbler. When the jar is filled, put the paper on top of the jar, and squeeze the top down with the palm of the hand, putting a large part of the weight of the body on it. If the top goes down too easily, use thicker paper or two thicknesses.

LABELING BOTTLED HONEY.

As a general rule, use small circular labels. The big ones that cover up the whole jar do not give as pretty an effect, as a rule, as the small neat, tasty labels that give the customer a good chance to see the honey. It is the honey that sells; and if it is a fine quality, get the grocer to display it in such a way in his window that the light will sparkle through it, and I will guarantee it will sell.

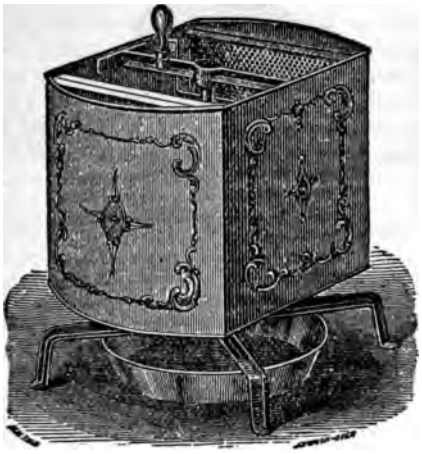
EXTRACTOR. The extractor, like the movable frame, is one of the things that have made a revolution in bee-keeping. It was invented in the year 1865 by Major Francesco de Hruschka, of Venice, who died at the good old age of 75, in the year 1888. Like a good many other inventions, its discovery was made by accident. His little boy chanced to put a piece of comb in a basket to which was attached a piece of rope. With rope in hand, the boy began to whirl it. The centrifugal force caused a few drops of honey to be thrown out of the basket around in the air, and the father, seeing it, was keen enough to see that in this was a *principle*, and the nucleus of a big invention, and that it was not necessary any

HRUSCHKA'S ORIGINAL HONEY-EXTRACTOR.

longer to smash the combs up and strain the honey out in the old-fashioned way. He very soon constructed a rude extractor that demonstrated the practical utility of the discovery; and, shortly after, perfected the

machine shown in the foregoing engraving.

Among the early extractors made in this country was one made by J. L. Peabody. This was so constructed that the whole can



THE FIRST HONEY-EXTRACTOR EVER SOLD IN THIS COUNTRY.

revolved, and the honey ran out through a hole cut in the center. But this was poorly adapted to the wants of the bee-keeper. In 1869 (see introduction) A. I. Root constructed what he called the "Novice" honey-extractor.

This was so great an improvement over all those that had preceded, that it found a ready sale at once. The inside baskets for holding the combs, in order to combine lightness with the greatest strength, were made of folded-tin bars and tinned wire cloth, four meshes to the inch. The crank was geared so that one revolution made three revolutions of the baskets.

EXTRACTOR WITH SPACE FOR HONEY BELOW REVOLVING FRAME.

REVERSING EXTRACTORS.

The basket in the Novice extractor requires the pulling-out of the combs in order to present the unextracted sides next to the can. This wastes time, as well as being awkward. About the time A. I. Root was experimenting with extractors, Thos. Wm. Cowan, editor of the *British Bee Journal*, constructed what was then known as and is still called the Cowan reversible extractor. To obviate the necessity of removing the combs, the pockets, or wire-cloth cages, were hinged, like an ordinary door, to a reel without a center-shaft. Combs could be put into these pockets; and when one side was extracted the pocket could be swung on its hinges the other side to, door fashion, without even stopping the machine, by merely slowing it up so the left hand could catch the edge of each pocket, throwing it around. The adjoining cut, while it does not

TWO-FRAME REVERSIBLE EXTRACTOR.

represent the original extractor made by Mr. Cowan, shows the Americanized machine. The mechanism has been greatly improved in workmanship and design; and it has already begun to exceed the sales of the cheaper Novice extractor. It costs but little more, but saves time and the awkward pulling-out of combs only half extracted. The can of the Cowan is only 3 in. larger than the Novice—20 in. outside diameter. The omission of the center-shaft—its place being supplied with a strong reel—to hold the pair of swinging pockets, makes it possible to use a comparatively small-sized can.

FOUR AND SIX FRAME EXTRACTORS.

Shortly after the two-frame Cowan was introduced in this country (1890), there came

a demand from the bee-keepers of the West, who produce honey by the carload, for machines that would do the work in a still more wholesale way than even the two-frame reversible Cowan. In response to this, four and six frame Cowan machines were made. The same principle of the swinging pockets was used in a large revolving reel, as in the two-frame machines, as shown in the next cut.

The four-frame machines differ from the two-frame (1) in that the reel has a center-shaft; and (2) that the swinging pockets are geared together. This is effected by the use of a sprocket-wheel and chain, one sprocket being attached to the bottom hinge of each pocket; and as each sprocket, or toothed wheel, is connected together by means of a chain and rod, the reversing of one basket will necessarily reverse the others simultaneously, so that, although the four and six frame machines are larger, the several pockets, or cages, can be reversed

INSIDE OF THE FOUR-FRAME COWAN.

more quickly than the two of the smaller Cowan, because in this each pocket has to be reversed separately. (3) And lastly the large machines differ in having street-car band-brakes and ball bearings. Ease of running and ease of stopping are important features in a large machine.

THE STANLEY AUTOMATIC EXTRACTOR.

This is a reversible extractor that was introduced into this country before the Cowan. Although it is *automatic*, the pockets reversing simultaneously with the reversal of motion, this machine never really gave good satisfaction. When every thing happened to be *just right*, the reversing could

be effected without any trouble, automatically. The machine was continually getting out of toggle, and finally it was abandoned for the Cowan. Although the Stanley is automatic, the reversing can really be accomplished as quickly, and certainly more satisfactorily, with the Cowan, and for these reasons the Cowan has run the Stanley out of the market.

RIGHT AND WRONG PRINCIPLES IN EXTRACTORS.

Some of the earlier machines sold in this country, notably the Peabody, made use of a revolving can without gearing. This was a mistake. For the last twenty years extractors have been built with *stationary* cans, inside of which the comb-pockets, reversible or non-reversible, revolve, motion being imparted by gearing so that one turn of the crank-handle makes two or three turns of the baskets. The present machines, with stationary cans, with gearing, ball bearings, baskets inside of the can reversible, and equipped with brakes, are about as near perfection as any thing can be. They have been put to the hardest kind of strain, and, like the bicycle, have gone through an evolution so that an excess of metal has been removed from places where so much was not needed, and placed on other parts where it *was* needed.

MORE EXTRACTED THAN COMB.

Some of the advantages and disadvantages of using a honey-extractor in the apiary are considered under the head of EXTRACTED HONEY. That more honey can be obtained by the use of the machine than by having it stored in section boxes in the shape of comb honey, all are agreed; but all are not agreed as to *how much* more. If it is nicely sealed over as it should be before being extracted, I do not think more than half

as much more will be obtained, on an average, although the amount is placed by many at a much higher figure. A beginner will be likely to get more extracted than if he relies upon having the bees work in sections; he will also be much more apt to take away too much, and to cause his bees to starve. This last is a very disagreeable feature attendant upon the use of the implement, especially where the bee-keeper is prone to carelessness and negligence. To secure the best results with the extractor, plenty of empty combs should be provided, that ample room may be given, in case the hives should become full before the honey is ripe enough to remove. If a second story does not give room sufficient, I would add a third for a heavy stock, during a good yield of honey.

DIRECTIONS FOR USING THE EXTRACTOR.

Much will depend on whether one has a large amount of honey to be extracted, or whether he is only a novice and wishes to use the simpler and cheaper methods. If he keeps bees in only a small way, and probably will not extract to exceed a thousand pounds in a season, the ordinary Novice extractor will answer his purpose; but as he never knows but that he may go into the business extensively, it would be better to purchase the two-frame reversible extractor, as the difference in cost is very slight. One of these will save labor, do quicker work, and more of it.

EXTRACTOR ANCHORED FOR WORK.

Having selected the machine, it should be placed on a box about as large as the bottom of the can, and about as high as an ordinary water-pail: that is to say, the extractor should be elevated high enough so that the honey-gate may empty into a common pail, something as shown in the accompanying illustration. Both box and extractor should be securely anchored down. As fast as the honey is extracted it is to be drawn off pailful after pailful, and then poured into kegs, square cans, or any large receiving-vat for holding the honey. This filling and emptying of the pails may seem to involve quite a little labor; but I know one of the largest honey-producers in the world, Mr. W. L. Coggshall (see Biographical Sketches), who uses identically this method.

Some prefer to have the extractor on a higher box so that the honey-gate can stand just over the bunghole of a barrel, thus allowing the honey to go directly from the comb into the marketing-package. But this necessitates raising the extractor to a point so high in the air that it is inconvenient to work, and awkward to put in and remove the combs. It is, therefore, desirable that the machine should be as close to the floor as possible on a low box, low enough so we can run the honey into the pail, or direct into square cans; but if the honey is first run into an open tin pail, its quality, and whether or not there are dead bees floating in it, can be seen before it is emptied into the regular marketing-packages.

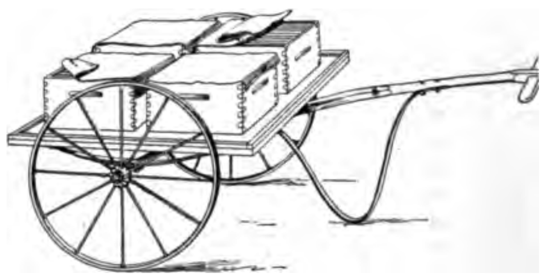
For a strainer a cheese-cloth sack attached to the honey-gate will answer very well in a small way, although something more elaborate will have to be used where the extractings are conducted on an extensive scale. It is then customary to run the honey through a strainer having a large surface, not less than three or four square feet. Or the honey may be conducted into large tanks, where all particles of comb can rise to the top and be skimmed off. The honey is then drawn off from the bottom into square cans and barrels.

Where the production of extracted honey goes up into the carload, or the tens of thousands of pounds, it is advisable to have an

extracting-building located on a side hill, the first floor of which should be on a level with the top of the hill, and the basement floor even with the base of the hill. The combs from the hives are then to be run on a comb-cart on a direct level with the extractor, which in this case will stand on the floor. In the room or basement below, just beneath the extractor, and communicating directly with it through a hole or pipe, should be a large storage tank that will hold from 5000 to 10,000 lbs. of honey at a time. Into this the honey runs direct from the extractor as fast as it is taken. From this the honey will be drawn off into square cans, the latter to be loaded on a wagon at the base of the hill.

The two illustrations given show somewhat how such buildings are used in California. Others use a pipe connecting directly with the honey-gate of the extractor, and leading directly to a storage-tank that is on a lower level, and off at one side. In either case the extractor is, of course, secured to the floor, and the operator is thus enabled to exert his power to the best advantage.

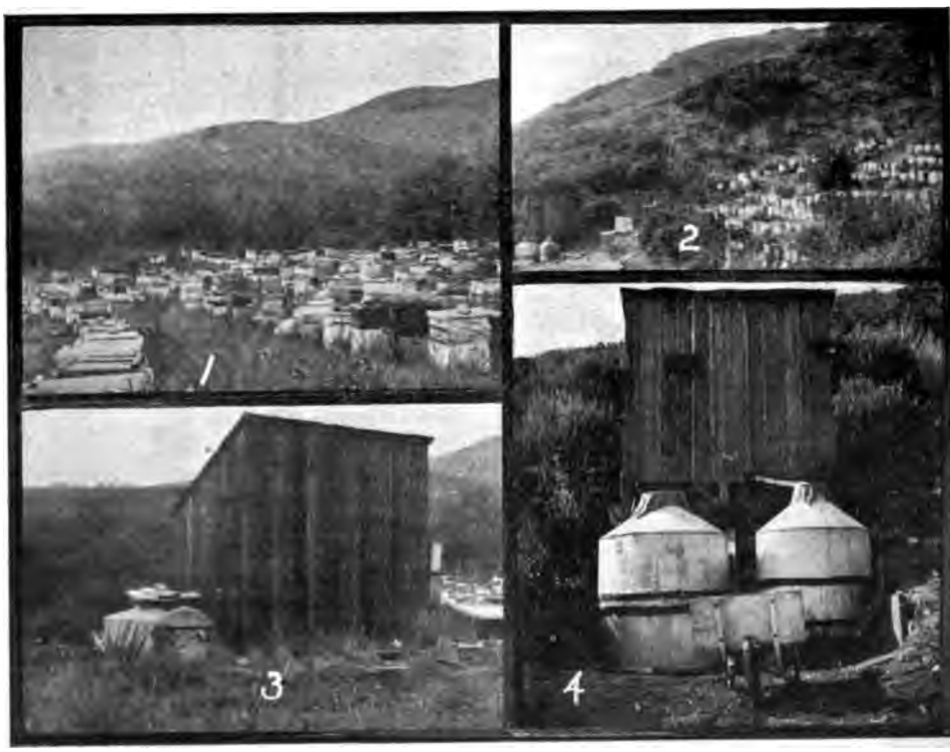
We next come to the matter of getting the combs out of the hives, transporting them to the extractor, and uncapping them. We shall need a wheelbarrow or handcart—preferably the latter, for the wheels are large,



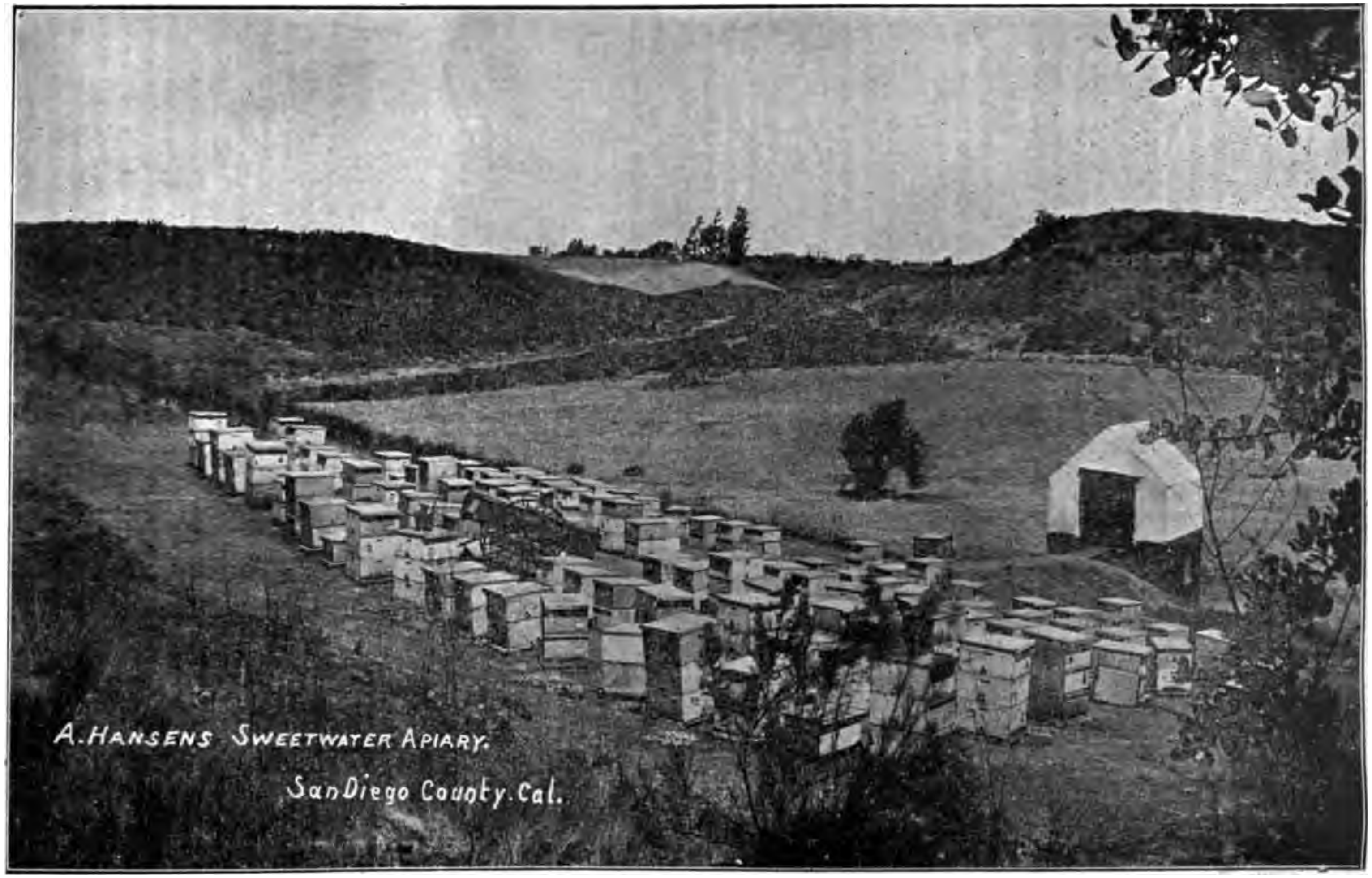
COGGSHALL'S EXTRACTING-CART.

and the burden is sustained entirely by the cart. The one I recommend is shown above.

This, as will be seen, is nothing but a handcart without a box. The tray or bottom has cleats around the outer edges, to hold the hive-bodies or supers that are placed thereon from sliding. This cart, with the supers, is run close to a hive. Over the whole four, or over each one individ-



THE HITCHINGS AND M'CLURE APIARIES, SHOWING HONEY-TANKS ON A LEVEL LOWER THAN THE EXTRACTING-HOUSE, NEAR BURBANK, CAL.

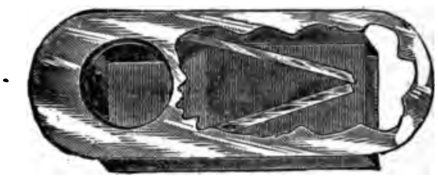


AN APIARY OPERATED FOR EXTRACTED HONEY, SHOWING THE PLAN OF RUNNING THE COMBS DOWN HILL INTO THE EXTRACTING-ROOM, EXTRACTOR IN THE UPPER ROOM AND THE HONEY-TANK BELOW.

ually, may be placed a wet cloth or cloths, the purpose of which is to shut out robber bees that may be hovering around; for bees are quite disinclined to push up under a *wet* cloth. We next open the hive, pull out one comb and give it a rapid shaking motion in front of the entrance. The Coggshall bee-brush attached to our person by means of a string (see VEILS) will brush off the remaining bees. We then place the frame in one of the supers on the cart. The next comb is then removed; but instead of being shaken in *front of the entrance* it is shaken *in the hive*. The few remaining bees are then dislodged with the brush, as before explained. In this way the four supers on the handcart are filled with combs, and are then run to the extracting-house. On arriving

OSBURN'S COMB-CART.

here they are taken care of by a couple of helpers. We then take back with us on the cart four other empty supers, which are filled as were the others; but where one carries on bee-keeping in a limited way, an ordinary wheelbarrow with two supers on would answer. In that case one operator might take off combs, run them into the extracting-house, extract them, bring them back, and put them on the hive again. Or he might put in the house a dozen or so of supers and then extract. The method or methods can be varied to suit the individual conditions that may exist; but in any case let me urge the importance of having pants tucked in the tops of boots, or, if shoes are worn, in the tops of the stockings: for during the operation of shaking the combs the bees will be almost sure to crawl up one's trousers legs. It would also be a wise precaution to have long sleeves, on the ends of which are sewed gloves having the finger-tips all cut off. These, when put on over the coat or shirt sleeves, will prevent the bees from crawling up the sleeves or attacking the wrists.* But all this annoyance of bees crawling up the trousers legs, and shaking and brushing off the bees, stings, and robbers, may be avoided by the use of the bee-escape. If there are a hundred supers to extract the next day, a hundred bee-escapes can be placed under the supers the night before; then during the afternoon of the next day one can go to the hives and take off super after super, and find scarcely a bee on a comb: nor does it in any way anger any of the colonies. A little smoke at the entrance will prevent the guards from flying



PORTER BEE-ESCAPE.

out and attacking while the super is being removed. These hundred supers, six or eight at a time, can then be run to the extracting-house, on the hand-cart, with never a robber in sight, even during the robbing season; and if the extracting-house is as tight as it surely ought to be, the extracting can be done at any time with ease and pleasure. But at out-yards it is sometimes impracticable to use escapes unless two trips are made—one to put on the escapes and

USING THE COGGSHALL BEE-BRUSH.

* See Coggshall's bee-suit, under VEILS.

the other to take off the honey. Some apiarists think the extra trip more than offsets the inconveniences of the brushing and shaking of the combs.

UNCAPPING-CANS.

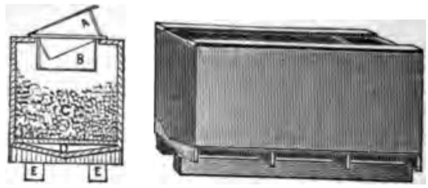
In some localities the combs may be taken out of the hive when they are half capped over; but it is a much safer rule to wait till the cells are pretty well covered before attempting to extract. The honey will be thicker and richer, will sell better, and the product will always be in demand from that time on. As to uncapping, I know of nothing any better than the Dadant uncapping-can, and the mode of procedure is illustrated in the cut below.

DADANT'S UNCAPPING-CAN.

This is something like an ordinary extractor-can, only it is made in two pieces — the upper one slipping into the other. A wire-cloth partition, as shown in the cut, catches the caps as they fall, and the honey drips down, to be drawn off through the gate. The very finest of the honey will come from this uncapping-can, as it has all been ripened and sealed. A wooden frame with two arms extends across the top, and is at a convenient height. Centrally through the intersecting piece at one end passes a screw which may be lowered or raised and the end of which is sharpened to a point. On this point the frame to be uncapped is pivoted, so that one side or the other can be turned very readily for the knife. The cappings, as they fall, easily pass down between the two side arms, dropping on to the screen below. The honey-knife can be readily scraped on the wooden arms in the manner shown in the illustration, without dulling the edge.

M'INTYRE'S UNCAPPING-BOX.

The cut below shows the device used very successfully by Mr. J. F. McIntyre, one of



those extensive bee-keepers in California who produce honey by the carload, and the following is his description, taken from *Gleanings*, page 770, Vol. XVIII.:

It is 2 feet wide, 2 deep, and 6 long outside, made of ⅞ lumber dressed on both sides. The bottom is 2 inches lower in the middle than at the sides, and is lined with tin to keep it from leaking. Eleven pieces of wood, 1x1x22 inches, are laid across the bottom about 6 inches apart to support the screen which the cappings fall on. This leaves room below the screen for the honey to run to one end, where it passes out through a tin pipe. Two pieces, ⅞x8x72 inches, are nailed on the top edge, one on each side, to contract the top of the box to the same width that a Langstroth hive is long inside. Two pieces, ⅞x⅞x18⅝, nailed one on each end between the two last mentioned, bring the ends up even with the sides. One piece, ⅞x3x18⅝, is fixed across the top of the box about 14 inches from one end, with an iron pivot sticking up through it, 1⅛ inches high to rest the combs on. When uncapping you set one end of the comb on this pivot, uncap one side, whirl it around, and uncap the other side, and set the comb in the end of the box, as in the diagram. When we have a surplus of combs we often hang them in the other end of the box, in the diagram. C is cappings, and D the space for the honey to run out.

The bottom of the box is 7 inches from the floor, which leaves room for the honey to run into the strainer arrangement below. This makes the top of the box about 32 inches from the floor, which is about the right height for me to uncap easily. A shorter person might make the box a little shallower, or lay a plank on the floor to give the right height, which is the way I do when my wife uncaps. I know most people will think this box unnecessarily large. I will tell you why I think it is not. When uncapping over a round can like Dadant's, the cappings fall on top of those taken off earlier in the day; and when the can is half full the honey has to pass through such a pile of cappings that it takes a long time for all to run out; and when you put the cappings in the sun extractor they are heavy with honey. With this box, when a pile of cappings accumulates under the knife we take a four-tined fo

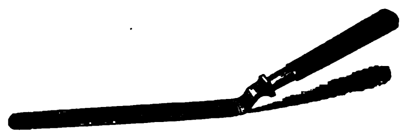
and pitch them over to the other end, where they may drain for 4 or 5 days. There is a small stream of honey running out of the box all the time, day and night, during the extracting time; and when the cappings go into the sun extractor they are almost dry. I think it pays well for the extra space in the box, because all the honey which goes into the sun extractor is spoiled for the market.

J. F. McINTYRE.

There are many substitutes for uncapping-cans. W. S. Hart, of Hawks' Park, Fla., sent us a sketch of one he uses, made of a common cheap wooden bowl. A tube is fastened to the bottom of the bowl, extending down through the table into a honey-can or barrel. A wire-cloth screen is put over the top of the bowl, to catch the cappings; and as the bowl turns on the tube the comb can easily be swung around in any position while shaving the caps off.

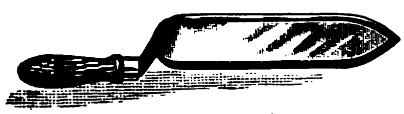
UNCAPPING-KNIVES.

There are two forms of uncapping-knives used. One, the Novice, has a thin flexible blade, made of steel. The other, the Bing-



THE NOVICE HONEY-KNIFE.

ham, has a thick flat trowel-shaped unyielding blade having edges beveled on the under side. The first mentioned will do uncapping, and is very handy for scraping bottom-boards or removing burr-combs on



BINGHAM & HETHERINGTON HONEY-KNIFE.

the inside of the hive. Being thin and flexible it will fit curved surfaces; but for uncapping only it is in no sense to be compared with the Bingham.

HOW TO USE AN UNCAPPING-KNIFE.

The blade should have a keen razor edge before beginning work. Within easy reach of the uncapping-can or box there should be a small single-wick oil-stove having on top a pan of hot water large enough to take in the blades of two Bingham knives; for where there is any considerable uncapping to be done there should always be two knives. Pick up the comb by one end; stand it on the point on the wooden framework, and lean it forward as in the illustration on the preceding page; then with the edge of the knife begin at the *bottom* end of the comb. Run the knife across the cappings, working it back and forth saw fashion. As the knife is moved upward, the cappings will fall away from the frame and the blade; and when the knife reaches the top the whole sheet will drop down into the uncapping box or can. Turn the comb on its pivot, and treat the other side in the same way. As each film of capping is shaved off, wipe the blade on the wooden cross-arm of the uncapping-can; or, if it is a box, on the side of it. Every now and then put the knife back into the hot water and take out the other one and begin work as before. To do nice, clean, quick work, the knife should be reasonably *hot*, *clean*, and *sharp*.

SHALLOW OR FULL-DEPTH EXTRACTING-COMBS.

The question is often asked, whether it is better to use the shallow extracting-frames that are advertised in most of the dealers' catalogs. This depends a good deal on the honey-flow and general conditions. If the frame is as deep as a Quinby, the shallow frame for extracting purposes is almost a matter of necessity, as it is very inconvenient to handle these large combs, both in uncapping and extracting. But shallow combs have a special advantage in that bees will enter a super containing them quicker than they will one of full depth. There is not so much room in the shallow supers for them to keep warm at one time; and they will, therefore, fill a set of shallow combs when they would hardly deign to enter an upper story containing full-depth ones. It is a common practice with a good many practical bee-keepers to have both shallow extracting-combs and full-depth combs. After the bees are well started to going above, the full-depth supers may be used. They may be also used on all strong colonies; but in the case of the weaker ones only the shallow ones should be given. It is thus possible to get extracted honey from weak stocks.

USE OF PERFORATED ZINC FOR EXTRACTING.

Unless perforated zinc is used to prevent the queen from going into the upper story, she will, to a greater or less extent, deposit eggs there; and the consequence is, brood is reared just where we do not desire it. The practical bee-keeper wants all of that confined to the brood-nest. During 1889 and '90 we had several testimonies to the effect that zinc excluders, placed between the

brood-nest and the extracting-super, did that effectually. Here is an article, written for *Gleanings*, which I take pleasure in copying. It is from the pen of Mr. McIntyre, as referred to above.

I have taken so much comfort with my 450 zinc queen-excluders this season, I am sure it will be doing my neighbors a kindness to tell them how they work. My hives, and, in fact, nearly all the hives in Ventura County, are made with a bee-space in the bottom and top of both super and brood-chamber, which, when the super is on, leaves ⅜ of an inch space between the super and the brood-frames. I have always thought this a mistake; but when I began to think of using queen-excluders, I saw that, if a plain unbound zinc excluder, the size of the outside of the hive, were laid on the brood-chamber, and the super on the excluder, the bee-spaces would be all right. I ordered 480 of Root's No. 1 unbound zinc excluders large enough to fit my hives. I think No. 1 the best, because they allow the bees to pass up and down more freely than the break-joint excluders. After trying 450 of these unbound excluders one season, I am satisfied that they are better in every way than the bound excluders. The super is easily lifted off the zinc, and, by taking hold of one end of the zinc and pulling up and out, they can be peeled off almost like cloth; and if they bend a little, just turn them upside down when you put them on again. I bought the excluders because I had a good many drone combs in my supers; but I would not do without them now, if my super combs were all worker size. It makes a fellow feel good to open a super just before swarming commences, and find about a square foot of drone comb all cleaned up for the queen to lay in. It is ever so much nicer to fool the bees in this way than to shave the heads off the drones. You don't always get around in time to shave the drones' heads off, and what a lot of honey is wasted in rearing them!

When you have no excluder on a ten-frame L. hive, the bees will fill about 7 combs in the brood-chamber with brood, and then run it up in the super instead of filling the brood-chamber clear across. This brood in the super is a great nuisance when you are extracting. In California we leave our supers on all the year round; and if the super is full of honey in the spring the bees will build up faster than they would if the hive were contracted. Another point I did not discover until I put excluders on all my hives: When the queens are allowed to go into the supers, a good many are knocked off on the ground, and lost, when brushing the bees off the combs. I did not find a fourth as many queenless colonies after extracting this season as usual. I found a few queens that could run up and down through the excluders, but not enough to trouble seriously.

J. F. McIntyre.

The use of perforated zinc promises, at no distant day, to revolutionize the methods of producing extracted honey.

EXTRACTING-HOUSE OF W. L. CHAMBERS, PHOENIX, ARIZONA.

F.

FAIRS—*How they may be used in the development of the bee and honey industry.*—Of late, very much indeed has been accomplished by the exhibits of bees, honey, and apiarian implements at State and county fairs. Several of the larger societies have had very pretty buildings erected on the fair-grounds for these displays, and often the bee-keepers who meet at such places have very interesting conventions.

Such exhibits have a decidedly educational influence on the public. They show *how* honey is produced; and not only that, but that it can be produced by the ton and carload. On account of newspaper yarns, there seems to be a general impression among people that comb honey is manufactured, and that the extracted article is adulterated with glucose. It is absolutely impossible to manufacture comb, fill it with honey, and cap it over with appropriate machinery—just as impossible as it is to manufacture eggs. We have had for several years a standing offer of $1000 to any one who would show where comb honey was manufactured, or even procure a *single manufactured sample* which could not be told from the genuine. Although this offer has been published broadcast in the daily papers, no one takes it up. We have also had the conditions of this offer printed on a neat little card, the same distributed by bee-keepers at fairs and other honey-exhibits, so that the general public could see at once, that, if such a thing were possible, and if The A. I. Root Co. is responsible, there would be a bonanza for somebody. As to extracted honey, there is, perhaps, more adulteration than we wish for. See HONEY ADULTERATION.

Bee-keepers, besides educating the general public as to the *genuineness* of their product, can create a larger demand for honey. As a usual thing, exhibitors are allowed to sell their honey, distribute circulars, and do a great deal of profitable advertising. This not only helps the individual, but helps the pursuit in general.

The accompanying engraving will give an idea of how a model exhibit should be arranged. This exhibit was under the direct supervision of Dr. A. B. Mason, at the Columbus, Ohio, Centennial.

A PARTIAL VIEW OF THE APICULTURAL EXHIBIT AT THE COLUMBUS CENTENNIAL, WITH SOME OF THE PROMINENT BEE-MEN IN THE FOREGROUND.

There should be shelving arranged in the form of pyramids, octagons, semicircles, etc. The honey should be put up in tin and glass, in large and small packages, and the whole should be neatly "set off" with appropriate labels. As a general thing, glass packages should have a very small label, so that as much of the liquid honey as possible may show. Tin receptacles should have labels to go clear around the can. Comb honey should be put up in cartons and in shipping-cases; and yellow cakes of wax should be shown in a variety of shapes. Besides the exhibit of honey in various styles of packages, there should be a moderate collection of bee-supplies, so that, when the eager public come along with their strings of questions, they can be shown step by step the process of producing honey, and its final putting-up for market. A good many questions will be asked in regard to the extractor. It will be called a churn, a washing-machine, and every thing else except what it really is. And last, but not least important, there should be one or more observatory hives to show the folks how the bees behave when at home. A good many will want to see the "king-bee." Tell them it is not a *king* but the *queen* that bosses.

By all means look well to what may be accomplished at the county fairs; and if those near you are too much given to gambling schemes and horse-racing, make it your business to interest the boys who go there, in learning some wholesome, honest industry.

FEEDING AND FEEDERS.—Feeding is practiced for one of two purposes—to stimulate brood-rearing at times of the year when no honey is coming in from natural sources, or to supply colonies with food at the approach of winter that are short. Whenever possible, feeding should be avoided; for at best it is a messy job, expensive, and, in the case of the beginners, liable to cause robbing. In a good locality it may be possible to avoid feeding altogether. Especially would this be true in those places where there is plenty of buckwheat or fall flowers. To buy sugar by the barrel every fall is very expensive, and the bee-keeper should lay his plans to avoid it as far as possible. In many cases fall feeding is made necessary by extracting too close, in some cases even from the brood-nest. This is bad practice and decidedly poor economy. But there are times when it is absolutely necessary to give the bees food either to keep up or stimulate brood-rearing or to prevent actual starvation.

If the honey already in the hives in the fall is of good quality and nicely sealed in the comb, it would be penny wise and pound foolish to extract it, put it on the market, buy sugar, make syrup, and feed it to the bees. There would be very little gained by it, even if the honey sold at a higher price, and the sugar syrup were cheaper. But if the natural stores be dark, and of poor quality, or bad honey-dew, it might be advisable to extract and put in their place the syrup. But of late years it has been our practice to let the bees have every thing of their own gathering, provided it is nicely ripened and sealed in the comb, no matter what the source; and it is very seldom we lose bees in outdoor wintering by reason of poor food.

Of course, sugar syrup is better than some honey that the bees gather; and, pound for pound, it will go further in the hive as a food. Some experiments were made a few years ago which went to show that of those colonies fed on honey, the average consumption in winter was from 14 to 18 lbs., while those fed on sugar syrup consumed from one to 7 lbs. The inference drawn was that, while the pound of honey had less strength than the pound of sugar, it was more stimulating, causing the bees to consume more of it. But in all probability this experiment showed too great a difference in favor of the sugar syrup. Under ordinary conditions, when the honey is of first quality, as, for instance, clover or basswood, there would not be any thing like this difference.

The difference in cost between a first quality of extracted honey and sugar syrup when sealed in the comb is so little that, if I had combs of good natural stores, rather than extract them I would set them aside, and then in the fall give these combs to such colonies as had an insufficient supply. But in any case I would not use all such combs, because, during midwinter, it is sometimes very handy to have them ready, as they can be placed right down in the center of a brood-nest of a colony, for the simple reason that it is impracticable to give liquid food to bees during midwinter. If combs of sealed stores are not to be had, I would give cakes of candy, as described under CANDY elsewhere.

WHAT TO FEED.

It is bad policy to feed any form of sweet that is cheaper than any of the very best granulated syrups. There are certain grades of molasses and sorghum that may be used; but, as explained, they have a tendency to be unduly stimulative, that is, make the

bees restless during winter. It seems to be generally agreed that, dollar for dollar, granulated sugar, when converted into first-class syrup, is as cheap a food for the bees as can be had; and not only cheap, but comparatively safe.

HOW TO MAKE THE SYRUP.

There are two ways of doing this. One is to use the cold process, and the other what is known as the old-fashioned way, using artificial heat. By the last method it is usually the rule to take a wash-boiler or any tin receptacle that will hold 50 or 100 lbs. of syrup at once and set it on the stove. Into this is poured granulated sugar and water in the proportion of one-half sugar and one-half water by measure or weight. Heat is applied slowly while the mixture is stirred. Whenever heat is used, one should be careful not to heat the mixture higher than 180 degrees. True, it may be brought to the boiling-point and not be injured; but if it is made a little hotter it is liable to be scorched or burned, and burnt sugar is death to colonies in winter. The syrup should be continuously stirred until every particle of sugar is dissolved. The fire should then be dampered down, and when the syrup is cool it is ready for use.

THE COLD PROCESS OF MAKING SYRUP.

On account of the liability to burning, messing of stoves and the kitchen, and on account of the greater convenience, it is now the common practice to use the cold process, which, briefly stated, is as follows: Mix granulated sugar and cold water, equal parts by measure, and stir until it is all dissolved. If the syrup is to be made in any quantity, pour the sugar and water into an ordinary honey-extractor, in the proportions above named; but the requisite quantity of water should be *put in first.* Start the reel going, and while it is going pour in a dipperful of sugar at a time. This gives the sugar, as it is poured in, time to mix with the water while the machine is in motion. Be sure not to make the mistake of pouring *all* the sugar in first and the water afterward, as the mixing will not be so well done.

After the can is full enough, keep turning the crank until the sugar is *all dissolved.* At first the mixture will look a little cloudy; but this is owing to the air-bubbles, which will disappear in an hour or two, when the syrup will be clear and limpid.

The proportion of half and half is recommended because it is better to feed the syrup thin than thick, for then the bees will ripen it; and when syrup is thickened and ripened by the bees it will not granulate, but make the finest and very best of food; but if for any reason feeding has been deferred till quite late, when the nights are frosty and the days somewhat cool, it may be advisable to use 4 parts of sugar and 3 of water; but bear in mind, the syrup when sealed in the combs will probably not be as good. Thick syrup is more liable to sugar in the combs.

If no extractor is to be had, an ordinary wash-tub and a good big paddle or stick to bring about the necessary agitation may be used. But a honey-extractor is away ahead of any other contrivance, and no one should think of trying to keep bees without one.

If only a small quantity of syrup is required—a gallon or so—it may be made in a small dish, using a big spoon or stirring-stick; but in such case I would pour the sugar into a vessel and then pour boiling water on the sugar, stirring while the water is being poured in. Boiling water may be used in lieu of cold water in the extractor; but the syrup, I can assure you, will be no better.

FEEDING TO STIMULATE BROOD-REARING.

During spring or summer we *can* use a cheaper grade of sugar, if we happen to have it on hand, or cheap or off grades of honey that would ordinarily be unsalable. If honey, I would thin it down slightly with warm water; but if the sweet has to be *purchased,* then, as I have already said, I would recommend only granulated sugar, for the reason that it is just as cheap as any other sweet, and the very best. Nuclei, as a rule, require stimulative feeding before or after the honey season, in order to make them do their very best, for a queen will seldom lay much after the honey season unless the bees are fed a certain amount daily. In getting colonies up to good strength to gather the honey harvest, or induce nuclei, or full colonies, for that matter, to build cells for the purpose of queen-rearing, the daily feeding of half a pint of syrup should be practiced.

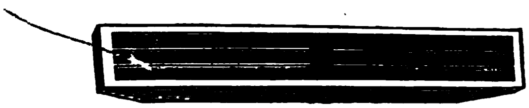
FEEDERS FOR STIMULATING.

There have been hundreds of feeders invented and put on the market. Some of them are very complicated, and the more so the less useful. If one desires to keep down his investment he may use common tin pans. These can be placed in the upper story of the hive, and filled with syrup. On top of the syrup should be laid carefully a strip of cheese-cloth that has been dampened in water. The bees will crawl up on the cloth,

and appropriate the syrup, without danger of drowning. But one objection to pans is that it litters them up; and after the feed is all taken, the cloth is likely to be stuck down by the dried crystals. But boiling water will very soon clean them.

Another feeder that has been used very largely consists of a common butter-tray, such as one gets at the grocery when he buys butter. A hundred of these can be nested together so as to take up but very little room, and the price is insignificant. It is not necessary to use cheese-cloth with the butter-tray. Set them on the top of the frames, and fill them with syrup.

A feeder that has been used very largely is the Simplicity trough feeder. It is an



SIMPLICITY BEE-FEEDER.

excellent feeder, cheap in price, and occupies very little room on top of the brood-frames.

Another feeder is the pepper-box. It is a can, pint or quart in size, with a perforated

PEPPER-BOX FEEDER.

top. This is filled with syrup, inverted, and then set right over the brood-frames in the upper story.

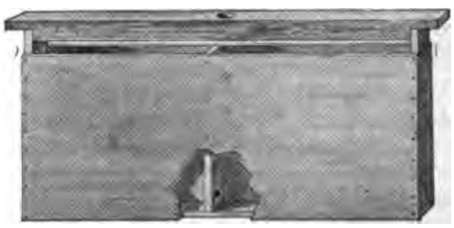
Still another feeder is the Boardman. This makes use of a Mason jar—something that is a common commodity in every household. The jars are filled with syrup; and with the special cap that is furnished by the manufacturers of bee-keepers' supplies, one can feed a large number of colonies at once.

The cans themselves when inverted are set down through a hole in a sort of box closed on all sides except the front. The two side pieces of this box are made in such a way as to leave projections which extend clear into the entrance, thus barring robbers from dodging into the box. The top of the box has a hole just large enough so that the Mason jar will be supported ¼ inch from the inside of the bottom. When one has a supply of Mason jars, all he will require from his manufacturer will be the box and a special cap that permits the bees to get the syrup in small quantities at a time. As this is an entrance feeder it is always in sight, and one can see at a glance whether the jars are empty or not.

A wheelbarrowful of filled cans with the special caps may be run through the apiary; and whenever a can is discovered that is empty, it is taken out of its box and replaced by another jar filled with syrup. The

THE BOARDMAN ENTRANCE FEEDER.

special feature of this feeder is that one can see by a glance at a row of hives those colonies that have emptied their cans, and a fresh supply can be given without disturbing the bees or opening the hives. But it has one objection—it has a tendency to incite robbing; but if one is careful, and sees that the caps to the cans are properly adjusted, there will be little or no trouble. But it is not the most satisfactory feeder for weak colonies.



DOOLITTLE DIVISION-BOARD FEEDER.

The one we recommend and use above all others is the Doolittle division-board feeder. The illustration accompanying shows that it is nothing more nor less than a large brood-frame paneled on each side. Down through the center runs a partition reaching almost to the bottom. This feeder from the very nature of its construction can be set down in the brood-nest like an ordinary division-board or brood-frame, for that matter; and as it is confined wholly within the brood-nest, not even requiring an upper

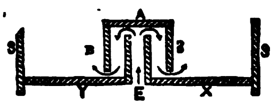
story or super, it is the most convenient and most satisfactory of any thing we ever used — fully as handy as the Boardman. All that is necessary is to slide the cover about an inch; then with a coffee-pot pour feed through the hole, as shown. Close the hive up and treat the next one the same way. For stimulating *weak* colonies or nuclei for the purpose of queen-rearing, our people unhesitatingly pronounce it by all odds the best feeder in the whole list.

There is still another feeder, and a very excellent one, and that is the Miller. We use it almost exclusively for feeding up colonies for winter. This has a large capacity, and one can feed any time from 10 to 25 lbs. at a feed. When for any reason feeding has

THE MILLER FEEDER

been deferred till late, this feeder is the one to use. The small feeders before described are adapted to stimulative purposes, and will hold only a quart of syrup at most; but we use the Miller feeder only when we may desire to feed up a large number at once.

The first cut shows the feeder adapted for an eight-frame Langstroth hive, and its capacity is 25 lbs. of syrup. The accompanying cross-section shows that there are two



feed-reservoirs. On the principle that liquids always seek their level, the syrup passes under the raised partition B; and the bees, to get access to the syrup, start from the arrow E, and take the feed from the inner chambers under the cover-board A. With most feeders of the kind, bees are obliged to pass through the two ends or the outside; and sometimes in cool weather, refusing to leave the center of the brood-nest, they will fail to take the syrup. The great feature of the Miller feeder is the fact that the passageway to the feed is located directly *over the center* of the brood-nest, and the warmth of the cluster rising is confined in the passageways and chambers under A. This feature, coupled with the fact that it is made of wood, makes it possible to feed bees during quite cold freezing weather.

Large or small amounts can be fed according as the circumstances require. The feeders we use hold 25 lbs. of syrup when filled within an inch of the top edge. If we discover that some colonies need 10 lbs. and others 5, and still others 25, to give them the requisite amount of winter stores, at the time of feeding we fill each feeder to the proportionate needs of the several colonies. Sometimes we fill only one of the reservoirs, which would make, when full, 12½ lbs. of syrup. For a 5-lb. feed, we pour in enough to make one reservoir a little less than half full. To expedite matters in feeding, just before giving the colony a final feed we go through the whole apiary, examine each brood-nest, and estimate* the amount of stores in pounds that each colony will need, marking the same on the slate, or with a piece of chalk on the cover-board of the hive. We afterward come around and distribute the feeders. Then toward evening, with a large feeding-can, we lift the hive-cover, pour in the amount of syrup as indicated upon the slate or cover, and close it up. Thus we do with all the colonies. The next morning we remove the feeders and pack the colonies in chaff, when they are ready for winter.

FEEDING FAST OR SLOWLY.

I have not been able to see that it makes any material difference whether we feed it all at once, or a little at a time for wintering purposes only; but for brood-rearing it is assuredly best to feed a little at a time, say a pint every night. I have, during severe droughts, reared queens, brood, and had beautiful comb built, by the latter plan.

FEEDING IN COLD WEATHER.

Although colonies have been wintered well when fed after cold or freezing weather, I think much the safer plan is to have it all done during warm dry weather, that they may have it all ripened and thoroughly sealed up. If the weather is not too cold you can feed with the Miller feeder as previously intimated. If you have been so careless as to have bees that are in need of stores, at

* A Langstroth comb, when filled and capped over with honey or sugar stores, holds on the average, about 5 lbs. To get at the amount of stores in a colony, estimate the amount in each comb, and the sum will give the amount. This amount, subtracted from the amount required to be fed, will, of course, give the amount to be fed. Some weigh each comb; but a very little practice will enable you to be accurate enough.

the beginning of winter, I would advise frames of sealed honey if you can get them; and if you can not, use CANDY, which see. If the candy is covered up with warm chaff cushions or something equivalent, it may be fed at any time, although it does not seem to be as satisfactory under all circumstances as stores sealed up in their combs.

In feeding in cool or cold weather, you are very apt to uncover the cluster, or leave openings that will permit the warmth from the cluster to pass off. I have several times had colonies die in the spring after I commenced feeding, and I imagined it was from this cause alone. When they first commence raising brood in the spring, they need to be packed up closely and snugly; making a hole in the quilt or cushions above the cluster, and placing the feeder over this so as to close it completely, does very well, but is not, after all, as safe as giving the feed from below: for feeding in early spring, especially if the stock is weak, I would prefer the candy, or well-filled combs of sealed stores.

WHEN ROBBERS ARE BAD, FEEDING AT NIGHT.

During the early fall of 1887 we found our apiary almost on the verge of starvation, the previous summer having been very dry. Robbers were unusually vigilant, and it was almost impossible to perform almost any manipulation with the hives without getting a perfect storm of robbers in the brood-nest. Feeding during the day was out of the question, and yet the colonies must be fed in order to prepare them for winter. Accordingly, to circumvent the robbers we fed at night by the light of lanterns. Contrary to what we might expect, the bees gave us but very little trouble by flying against the lanterns. As the bees took up all the feed in the feeders during the night, and the robbers had had no opportunity to investigate during the feeding, every thing was comparatively quiet next morning, and during the following day. We fed successfully in this way some three or four barrels of sugar. Although I have recommended feeding *toward* night, in the preceding paragraphs, in the case above mentioned we fed from about 7 P. M. in some cases until 10:30 P. M. Perhaps I should also remark, that, if it is inconvenient to work at night, feed on the first rainy day. Put on your rubber hat, coat, and rubber boots. As long as it rains, bees will not bother you.

For particulars regarding feeding back to fill out sections, see COMB HONEY.

SPRING FEEDING A LA BOARDMAN.

Mr. H. R. Boardman, of East Townsend, O., practices a plan which often ensures a crop of honey, even during poor seasons. In brief it is this: He feeds all his colonies as soon as it becomes settled warm weather, whether they need stores or not. The syrup is given them slowly to stimulate brood-rearing. This feeding is continued clear on to the honey-flow, when, of course, it is discontinued. The result is that the hives are overflowing with bees and brood, and all available space in the brood-nest is filled clear full with sealed sugar stores. Just as soon as the honey-flow commences, supers are given; and with a tremendous force of bees secured by stimulative feeding, and with a brood-nest already filled to its utmost capacity with sugar stores, the honey, when it *does* come, is *forced* right into the supers, because there is no place for it in the brood-nest.

Mr. Boardman was driven to this mode of procedure because of a series of very poor honey-flows one year after another. Figuring that sugar syrup cost only about a third as much as the first quality of comb honey, he reasoned that, if he could make a legitimate trade with the bees, he could take *their* product in exchange for his sugar, and almost treble his money.

While it costs considerable to feed bees in this way, I believe that Mr. Boardman's experience has been such that he feels warranted in continuing it; and then if the year proves to be a good one he will get a tremendous crop of honey. One year when I visited him he had secured a fair-sized yield from each colony, and a poor year at that, while his neighbors round about him did not get any surplus, and all they did get was brood-nestfuls of honey, and nothing more. Mr. Boardman also had his brood-chambers full; but instead of being honey it was sugar syrup, and the honey was in sections worth at least 10 or 12 cents per lb. wholesale, while I believe the sugar syrup cost him in the hive only about 4 cents. Clearly, he had made a good trade.

The feeder that is best adapted for this kind of feeding is the Boardman, already illustrated, because it is assumed that all colonies so fed are strong, and can make a proper defense at the entrance.

I would advise one who has never tried the plan to try it on a small scale. Feed up, say, 25 or 30 per cent of the colonies in the yard, and let the others go on in their own sweet way. Keep a careful account of the net

proceeds after deducting expenses; and if those fed show a *larger* balance on the right side of the ledger than those not fed, then next year one would be warranted in feeding the whole apiary *a la* Boardman.

But, of course, it must be understood that feeding should not be continued long enough to force the sugar syrup up into the sections, as that would be a fraud on the public. Nothing but the nectar of flowers when ripened by the bees should be sold as honey.

CAUTION IN REGARD TO FEEDING.

Before closing, I would most earnestly caution the inexperienced to beware of getting the bees robbing. Except in the case of the Boardman feeder, I have advised feeding only toward night to avoid danger; for attempting to feed in the middle of the day will sometimes result in the robbing and destruction of strong colonies. Where food comes in such quantities, and in such an unnatural way, they seem to forget to post sentinels as usual; and before they have time to recover, bees will pour in from all the hives in the apiary. I do not know who is to be pitied most at such a time, the bees, their helpless owner, or the innocent neighbors and passers-by. *Sometimes*, all that can be done is to let your colony slide, and wish for it to get dark that the greedy "elves" may be obliged to go home. Now when you commence feeding, remember that my last words on the matter were, "LOOK OUT!"

For open-air feeding, see WATER FOR BEES.

FERTILE WORKERS. See LAYING WORKERS.

FIGWORT (*Scrofularia Vernalis*). This plant is variously known as Square-stalk, Heal-all, Carpenter's-square, Rattleweed, etc., the name indicating some of its peculiarities, or real or supposed valuable medical properties.

The engraving presented will give a fair idea of it, and will enable any one to distinguish it at once, if it grows in his locality. The pretty little ball-shaped flower, with a lip somewhat like the pitcher-plant, is usually found filled with honey, unless the bees are so numerous as to prevent its accumulation. This honey is, of course, thin, like that from clover or other plants, when first gathered, and is, in fact, rather sweetened water; but still it is crude honey. We have had one report from a single plant under cultivation, and, as might be expected, the quantity of honey yielded was very much increased, and the plant grew to a great height, continuing to bloom and yield honey for full four months. The little flower, when examined closely, is found to be very beautiful.

It grows in its natural state among brush-heaps, in fence-corners, and amid hedges, to the height of from 3 to 6 feet. The seed is easily gathered in September and October.

In 1879 we had quite a field of this honey-plant on our honey-farm; and although the patch was small, it made quite a remarkable showing. The bees were busy on the blos-

FIGWORT HONEY-PLANT.

soms from morning till night, during the time it was in bloom. By actual count we found the number of bees that visited a certain flower in a certain length of time was about one a minute. Then the flower might not be visited again for two minutes; and again it would be visited twice in a minute. Careful observation showed that, after the bees had licked the flowers clean of nectar, another globule would exude from the nectaries in from one to two minutes. At the time, this plant created quite a *furore*, and it was thought that, for artificial pasturage, it would excel any thing else then known; for

a plant that would yield so many flowers, and nectar in such quantities, must of necessity produce wonderful results. But, unfortunately, it is very expensive to grow the plant. It must have deep, rich soil, and must be planted and cultivated like corn. The cost of growing it is such that the value of the honey would not warrant the expense. The seed has no value outside of bee-keeping, and it would probably require hundreds of acres to keep a hundred colonies busy. While it is true that it grows wild in certain localities, yet the area over which it grows is so limited and so scattering that in late years we have heard little or nothing about the plant; and all thoughts of stocking honey-farms with this plant have long since been abandoned. As has been stated elsewhere in this work, our honey-farms will have to embrace mostly alsike, buckwheat, rape, and perhaps the stock pea of the South, and such other plants as will pay for the crop they yield aside from the honey. See ARTIFICIAL PASTURAGE.

FIXED FRAMES. By these are meant frames held at certain fixed and regular distances apart by some sort of spacing-device, forming either a part of the frame itself or a part of the hive. Under SPACING OF FRAMES, elsewhere, and under HIVE-MAKING, I have discussed the distances that frames should be put apart. Some prefer 1½ inches from center to center; but the great majority, supported by the best of reasons, prefer 1⅜ inches. Fixed frames, then, are those that, when put into the hive, are spaced automatically, either 1⅜ or 1½ inches from center to center. Loose frames differ from them, in that they have no spacing-device connected with them, and are, therefore, when placed in the hive, spaced by eye—or, as some have termed it, "guesswork." Such spacing results in more or less uneven combs; and beginners, as a rule, make very poor work of it. The advocates of fixed frames claim that they get beautiful perfect combs, no burr-combs, and that, without any guesswork, the combs are spaced accurately and equally distant from each other. Fixed frames are always ready for moving the hives, either to an out-yard, to and from the cellar, or for ordinary carrying around the apiary. Loose frames, on the contrary, while they are never spaced exactly, often can not be hauled to an out-apiary, over rough roads, without having put sticks between them, or something to hold them together. It is contended by some, also. that fixed frames can be handled more rapidly. See FRAMES, MANIPULATING. On the other hand, the advocates of the loose frame urge, as an objection to the fixed frames, that they kill bees. In the summer of 1890, at his apiaries, I saw P. H. Elwood, the owner and successful manager of 1300 colonies, handle his closed-end frames easily and rapidly, and without killing bees. I witnessed Mr. Julius Hoffman, whose frame I will presently illustrate, handle his with equal facility, and during the ten years that we have handled them we find almost no trouble from bee-killing. Of course if the frames are handled carelessly bees will be maimed and killed. Capt. J. E. Hetherington, who runs successfully 3000 colonies, has them all on the Quinby closed-end frames.

There are a good many styles of fixed frames; but there are only two or three that are really good ones, and worthy of any serious consideration on the part of the practical bee-keeper. These are, the closed-end Quinby, the Danzenbaker, the Heddon, the Hoffman, the thick-top staple-spaced, and the Van Deusen reversible (see REVERSING FRAMES).

The closed-end Quinby is, as its name indicates, one whose end-bars are 1½ inches wide their entire length. The top and bottom bars are 1 inch wide. These closed uprights, or closed ends, when they come in

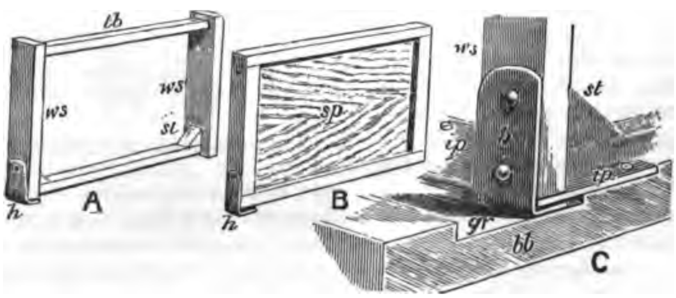


FIG. 1. HOW THE QUINBY FRAME HOOKS ON TO THE BOTTOM.

contact, cause the combs which they contain to be spaced accurately from center to center. Fig. 1, A shows one such frame. Almost all closed-end frames are made to stand, and have very often been called "standing frames." Mr. Quinby, in order to keep such frames from toppling over, invented the strap-iron hook on one corner, as shown in the accompanying engraving, re-engraved from Cheshire. *h* is the hook that engages the strap iron *ip* in the bottom-board; *gr* is a groove to admit of the hook, and at the same time render it possible to catch under the strap iron.

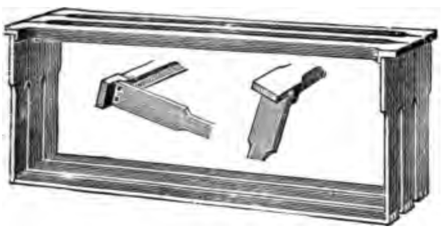


FIG. 2—THE HOFFMAN FIXED FRAME.

These hooks are on the outside of the hive proper, and hence they do not kill bees, nor are they filled with propolis as they would be if made on the inside of the hive. A and B are respectively the frame and the follower, although they are drawn somewhat out of proportion. With a panel on each side, a cover and a bottom-board, the Quinby-Hetherington hive is complete, the ends of the frames forming the ends of the hive; though, for additional protection in the spring, Mr. Elwood and Mr. Hetherington both use the outside case to set down over the whole. This makes a very cheap hive, and has many desirable features in it. For fuller details in regard to this frame, and its manner of construction, the reader is referred to "Quinby's New Bee-keeping."

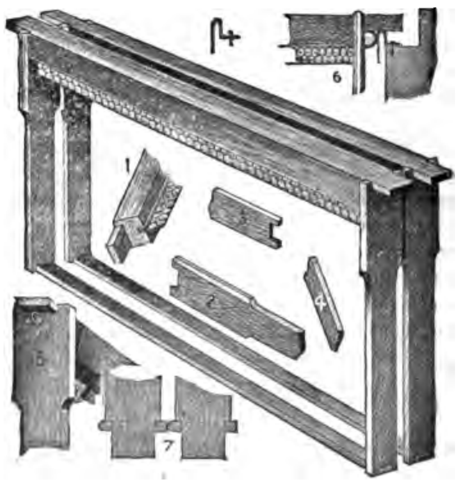
The great majority of bee-keepers prefer what is known as the "hanging frame." This has many very decided advantages over the standing frame; and there is no doubt that, for this reason, the loose frame is used so generally; but the hanging frame is also used as a fixed frame.

It will be observed that this frame can be used in an ordinary Langstroth hive (see HIVE-MAKING); and the end-bars are closed-end only within a couple of inches of the top. The rest of the frame, two-thirds of the way down, is narrowed down to $\frac{7}{8}$ of an inch. The top-bars are widened out at the ends, and are scored out in the middle to one inch wide.

After having used the Hoffman frame with top-bars widened at the end, and no rabbets, we began in the use of top-bars with the ends notched (see cut) and resting on the tin rabbets, as shown in HIVE-MAKING. After several seasons' use of the latter we much prefer them. The lateral feature is more perfect, and there is very much less liability of bee-killing. Indeed, with proper care there need be practically none.

Another feature of this frame is in the end-spacing staple that abuts against the tin rabbet shown in 6, in the cut. The ends of the top-bars are cut off so as to leave a bee-space around them. With the old-style frames the bees can sometimes glue the ends of the top-bars to the rabbet. This has all been done away with in the style of frame shown.

When the top bar is long enough to reach and almost come in contact with the ends of the rabbets, the bees will chink in bee-glue between the ends of the top-bars and the rabbets. When the ends of *all* the frames have been thus glued, it is somewhat difficult to remove any one frame, because the fastening of each frame must be loosened before the frames sought can be gotten out; but when the top-bar is shortened, as at 6 in



IMPROVED HOFFMAN FRAMES.

the illustration, and the staple is used, there is none of this kind of gluing, and the only fastening is that between the upright edges of the end-bars themselves; and this fastening, for the majority of localities, so far from being a disadvantage, is an advantage in that it holds the frames together while the hives are being moved, and yet does not hold them so fast but they can be easily separated.

For details as to its construction, see HIVE-MAKING; and the details as to its manipulation, see FRAMES, HOW TO MANIPULATE.

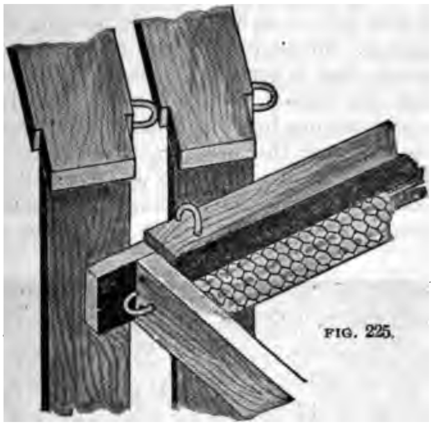


FIG. 225.

Again, there are others who prefer frames with staples as side-spacers, as shown. Where propolis is bad this frame may be preferable to the Hoffman. Although it was first supposed that the Hoffman could not be used in Cuba on account of the great amount of bee-glue, yet it is almost the only movable frame that is used there. There are very few localities in the United States in which they can not be used.

FIXED FRAMES—ADVANTAGES.

They give straight beautiful and regular combs; are practically free from burr-combs; can be hauled without any special preparation over the roughest roads, turned upside down, and rolled over without disturbing the combs. They permit, to a very great extent, of the possible handling of hives instead of frames. Under FRAMES, MANIPULATING, is shown how they can be handled in pairs and trios—in fact, half a hive at a time. They can also be inverted, thus causing the combs to be built out solidly to the bottom-bar; and, when once completed, they can be restored to their normal upright condition. They can be handled as rapidly as the loose frame. Indeed, Mr. Julius Hoffman, of Canajoharie, N. Y., the owner of some 600 colonies on Hoffman frames, says he can work nearly double the number of colonies with his frame that he can with any frame that is not spaced or close-fitting, and he has used both styles of frames. But not every one will be able to do this; and very likely some people would handle them very much slower than they would loose frames.[487]

FIXED FRAMES FOR SMALL BEE-KEEPERS.

Whatever we may say regarding the adaptability of Hoffman frames for the expert bee-keeper, I feel sure that, in almost every instance, they are better for the beginner or average farmer bee-keeper, or any one who does not propose to make any great specialty of the bee business, but desires to keep only a few colonies to supply himself and neighbors with honey. Such persons are apt to be a little careless, and, with ordinary loose unspaced frames, make bad spacing. It is seldom indeed that I have looked into the hives of this class of bee-keepers and found their loose frames properly spaced. In some instances the combs are so close together that opposite surfaces are gnawed down to give the bees sufficient bee-space to pass between; and in others they are spaced so wide apart that small patches of comb are built between; because it is an invariable rule laid down in bee-hive economy, on the part of the bees, not to leave more than a bee-space between. Now, then, whenever the Hoffman frames, or any standard self-spacing kind, is used, we always find the comb perfect; indeed, the self-spacing feature shows just how far apart the combs should be placed.

FOUL BROOD.

FOUL BROOD. In its broadest sense we might include under this heading chilled brood, overheated brood, starved brood, poisoned brood, pickled brood, black brood, and foul brood, because in a sense they are all foul; but, technically speaking, whenever the term "foul brood" is used it has reference to a peculiar disease that comes from a form of bacteria known as *Bacillus alvei*. Foul brood, the most generally distributed and best known, I will describe first.

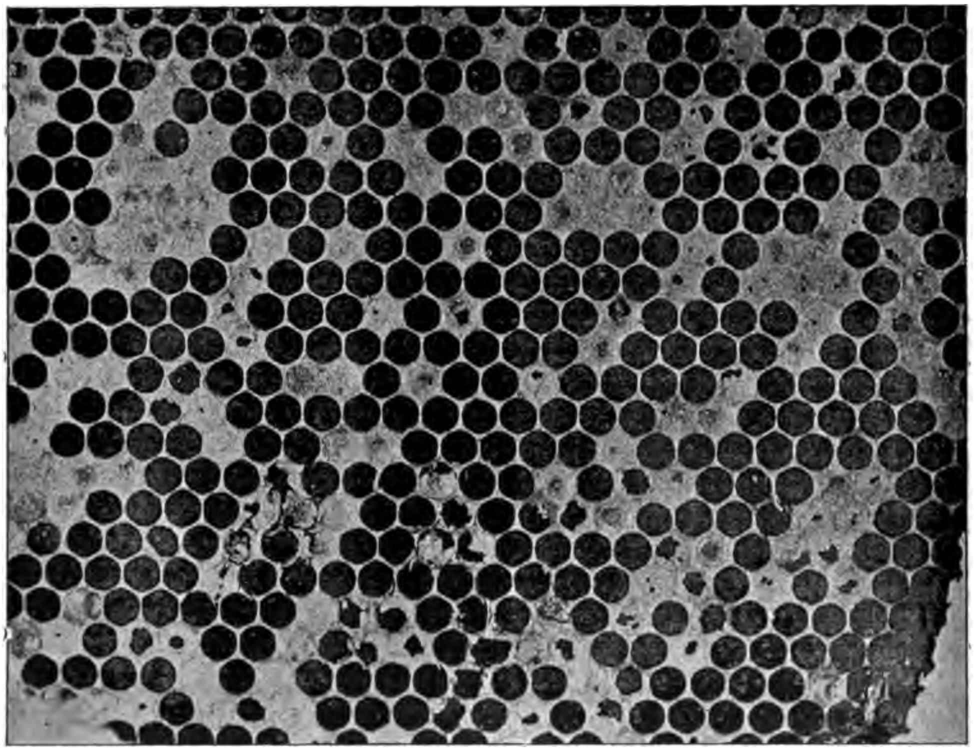
SYMPTOMS.

Some of the brood fails to hatch. Cappings here and there are sunken and perforated at the center.[90] On opening one of these cells there will be found a dead larva lying on one side of the cell, somewhat shrunken, and of a brownish color, varying all the way from a light pale brown to a dark brown. In the more advanced stages the brown is of the color of a coffee-berry after being roasted. In the incipient stages the brown is of the color of the coffee we drink, when greatly diluted with milk. But so far all these symptoms may be present as the result of chilled, overheated, starved, or pickled brood. But to determine whether it is the real foul brood, run a toothpick into the dead larva and then draw it slowly out

If the maturated mass adheres to the end of the pick, about like spittle — stretches out from one-half to one inch—and finally the fine thread breaks when the pick is drawn back, it is probably a case of foul brood. With all other forms of diseased brood, with perhaps the exception of black brood*, this ropiness does not appear; but with foul brood it invariably appears. Now, there is another symptom; and that is, the odor, while not exactly foul, resembles greatly that from a cabinet-maker's glue-pot; and when the disease is pretty well advanced in the hive, the odor will make itself manifest upon lifting the cover or quilt, even before exposing the brood. If other colonies are affected, and the disease spreads, it is unquestionably foul brood.

In the engraving on this page appears a typical specimen of comb affected with foul brood in an advanced stage. The perforations in the cappings, instead of being regular, are jagged, sunken, and of a greasy brown color. It would seem that the bees, realizing that something was sadly wrong, make attempts to open up the cells and remove the dead matter; but, evidently, the job is too sickening for their refined taste, and they give it up after merely opening the cappings. But there is a kind of pinhole perforation that is perfectly normal in healthy brood, and should not be confounded with the perforations for foul brood. Sometimes in hot weather the bees leave their young bareheaded, as it were; that is, there will be small openings in the cappings; but these openings are circular, and in the center of the cell; and if one peeks through he will see that the grub is white, and that all is well. But beginners who have discovered this peculiar condition have jumped to the conclusion that it was foul brood, without due investigation.

I speak of this so that one may avoid any possible mistake. The picture above is so characteristic that if one finds in his apiary a case as bad as this, accompanied by the dead and shrunken appearance of the larva, with a brownish color, the dead matter



APPEARANCE OF AFFECTED BROOD.—PHOTOGRAPHED BY THOS. WM. COWAN.

* Black brood, at certain stages, ropes very slightly, but never more than 1/8 inch, and the matter has a jelly-like consistency.

showing the stringy, ropy condition, he may rest assured, without further investigation, that he has the real disease, and should treat it accordingly; but unless the matter is ropy —stretching out at least one-fourth inch—it may be black brood; but if such it will not have the glue-pot odor. If it ropes slightly (⅛ inch), and has a sour smell, it is possibly black brood. The first intimation that one has of foul brood usually is the presence of one or two cells with ragged perforations. A comb with such cells will very soon, if neglected, have a large number of perforated cappings.

TREATMENT AND CURE OF FOUL BROOD.

Years ago this disease got quite a start in our own apiary before we realized what we had; and had we at that time an engraving or photo like what I have already shown we should have discovered the disease long before we did. As it was, we had to treat at a great disadvantage something like eighty colonies during that summer. Some of them we burned outright — hives, bees, frames, combs, and all. Others we treated with salicylic acid, carbolic acid, or phenol, but not with very satisfactory results. Indeed, if we had treated all colonies at the start by what we have called the starvation (or foundation) plan, we might have had the disease under control, and probably would not have had to exceed two dozen affected colonies all told. The method that finally gave us relief was as follows: As soon as a colony was discovered having a cell or two of the diseased brood it was closed immediately, and a brick or stone was laid on the cover. Just before dark, and while *all* the bees of the apiary were in the hives, and all danger from robbers was past, we removed the hive from its stand, and put another one just like it in its place. This hive contained frames filled with full sheets of foundation. The bees were shaken off from the diseased combs, either on top of the frames or in front of the entrance of the new hive now on the old stand. The combs, as soon as free of bees, were put back into the old hive, and the whole thing was carried to the boiler-furnace,* where the frames were burned in a hot fire. In some cases the hives were burned also, but more often they were closed bee-tight and set aside; and when we had an accumulation of them they were scalded in boiling water. The bees on the frames of foundation were not fed for three or four days, but were compelled to draw it out, thus consuming all the honey in their honey-sacs in the operation. When a few of the bees began to drop from the frames, as if from starvation, they were fed.

All colonies so treated were successfully cured; and never, that I remember, was there a single trace of foul brood in any of them.

THE M'EVOY TREATMENT; DISINFECTING HIVES.

I said I boiled or burned the hives; but Wm. McEvoy, Woodburn, Ont., Can., foul-brood inspector for Ontario, and in the government employ, reports having treated successfully hundreds and perhaps thousands of colonies by putting the bees back into the *same hive from which they came.* His treatment is thus given in his own language:

> In the honey season, when the bees are gathering freely, remove the combs *in the evening* and shake the bees into their own hive; give them frames with comb-foundation starters on and let them build comb for four days. The bees will make the starters into comb during the four days, and store the diseased honey in them which they took with them from the old comb. Then in the evening of the fourth day take out the new combs and give them comb foundation to work out, and then the cure will be complete.

Mr. McEvoy has probably had a wider experience with foul brood than any other man now living; and it is his opinion that it is worse than useless to use any form of drug, and that it is also a waste of time to disinfect hives; and the fact that he has treated successfully thousands of colonies, without doing any thing with the hives at all, would seem to indicate that such disinfection is unnecessary. However, when we had foul brood, for the sake of experiment we put the bees of a few colonies back into the same hives on frames of foundation. But the disease reappeared in several. While Mr. McEvoy may be right, it would seem advisable in the case of a disease so serious as either black or foul brood to disinfect the hive. So good an authority as Thos. Wm. Cowan, editor of the *British Bee Journal*, and one who has made foul brood a special study, strongly urges the disinfection of all infected hives. He would either scald them or paint the inside with a strong solution of carbolic acid.

It will be noticed that Mr. McEvoy puts the bees on *two* sets of frames of foundation, destroying the first set that they drew out. Whether the second lot is a necessary precaution I can not say; but the fact that we never had any trouble when using only one set would seem to indicate that was enough; but we were careful to see that all the honey was consumed in comb-building.

* When one does not have access to a furnace I would build a small bonfire, burn the combs, and then bury the ashes below plow or spade depth.

IS USING THE HONEY AND BEESWAX OF DISEASED COMBS RENDERED SAFE AFTER BOILING?

Some writers seem to think that the burning of frames and combs is a useless waste, and recommend extracting and boiling the honey, melting up the combs, and then boiling the frames, giving back both the honey and wax when made into foundation. But such a procedure, for a beginner, at least, is not only exceedingly dangerous, but, after all, does not save very much in the end. The amount of wax that one will get out of an old comb is not very great, and the honey would have to be boiled at least two hours and a half in order to *be sure of killing* the spores of foul brood. Such boiling would make a dark and very inferior honey; and as extracted of good quality brings but a comparatively low price, the boiled article, affected both in flavor and in color, would, as a matter of course, bring a less price.

An expert *careful* bee-keeper can extract the honey, boil it, and render up the wax to advantage, but not unless he has a large number of diseased combs.

Foul brood exists in two forms: 1. The bacilli, or actual germ life; 2. Spores, or eggs, as we might call them. The first form is very easily killed by boiling or by the use of antiseptics. The second, owing to the fact of their being incased within a thick double membrane, a boiling of one or two hours is not sufficient to kill them. Indeed, microscopic examinations show that these same spores will develop into bacilli after having been boiled one and even two hours. In support of this I would refer to the European scientist M. Genonceaux; Dr. W. O. Howard, of Texas; Prof. C. F. Hodge, of Massachusetts; scientist Brice, of England; bacteriologist J. J. McKenzie, of Ontario, and Thos. Wm. Cowan, editor of the *British Bee Journal;* and in addition to the experiments made by these men, J. A. Buchanan, of Hollidays Cove, W. Va., tried feeding back foul-broody honey that was boiled only ten minutes, with the result that it gave the disease to every colony so fed.

MEDICATING SYRUP TO PREVENT FOUL BROOD; DRUGS, AND THEIR USES.

I have already stated that we did not get very satisfactory results by the use of drugs when foul brood visited our apiary some years ago. We did find, however, that they invariably held the disease in check; but as soon as their use was discontinued the disease broke out again. I have explained also that the *spores* of foul brood are not easily killed by drugs nor even by hard boiling. But the bacilli, the germ life itself, after it has hatched, so to speak, from the spore state, is very easily killed with antiseptics or 212 degrees of heat. While I do not advise one to place his sole dependence on drugs, as an auxiliary to the regular treatment, they might and probably would prove very efficacious. They would also be very useful in preventing the breaking-out of disease if all syrups fed to bees were medicated. It would certainly do no harm, cost practically nothing, and might save hundreds of dollars.

Two antiseptics have been recommended. One is carbolic acid, and the other what is called naphthol beta. The former has such a strong odor that it is with difficulty, if at all, that the bees will take syrup medicated with it; but they offer no objection whatever to syrup having naphthol beta in it.

HOW TO PREPARE THE NAPHTHOL SYRUP.

Into an eight-ounce bottle (half pint) empty a one-ounce package of naphthol beta in the form of a fine white powder. Pour in just enough wood or common alcohol to dissolve the powder, and fill the bottle full. This quantity of chemical in solution is just right for 140 pounds of sugar dissolved in 140 pounds of water. To mix, put 140 pounds of water in a common honey-extractor; then add sugar gradually, dipperful by dipperful, until there are about 140 pounds of sugar. While the sugar is being added, keep turning the handle of the extractor so there will be a rapid agitation and thorough mixing. After the sugar is all in keep on turning the handle until it is all dissolved, and, last of all, pour in the naphthol-beta solution already referred to. Stir this into the mixture thoroughly by running the extractor for several minutes longer.

In handling the naphthol-beta solution, be careful not to get it on the fingers; but after it is mixed with the syrup it is perfectly harmless to man or bees. Naphthol beta can be obtained for 25 cts. an ounce; and at this low price no bee-keeper can afford not to take the precaution.

In making the syrup we recommend half sugar and half cold water. There is no need of heating provided thorough stirring is used, either with a stick and tub, or, better still, in an extractor in the manner explained.

The expense of putting this into the syrup would be very slight, and might and probably

would prevent the breaking-out of the disease, as I have explained, because it would immediately kill the bacilli as soon as they hatched from the spore form; and I would advise every bee-keeper who has once had foul brood in his apiary, or who is troubled by its occasional reappearance in his yard, to medicate all syrups he feeds to his bees. This, in addition to the regular forms of treatment prescribed by putting bees on clean frames of foundation, ought to put a quietus on the worst enemy with which bee-keepers have to contend.

Caution.—Do not handle the infected colonies during the day, or when robbers are nosing around. Do not attempt to satisfy the curiosity of other bee-keepers who would like to see what foul brood looks like, smells like, etc. If you use any sort of brush for brushing the bees off the combs into the new hives, either burn it up or keep it for a while in boiling water before using it again on healthy colonies. Nothing but an old smoker should be used in working with foul brood. The boards of the bellows may, perhaps, with advantage be painted with a strong solution of carbolic acid; but after having rid the apiary of foul brood, burn up the smoker. Disinfect every thing where possible, that has come in contact with combs or hives that are infected with the disease, by immersing in boiling water. It may not be necessary to boil the hives; but if it can be done at not too great expense it will do no harm. The hands should be thoroughly washed in water strongly tinctured with carbolic acid just strong enough so it will not quite peel the skin off the hands. A solution diluted 500 times, or the strength recommended in the phenol treatment, is hardly adequate.

So much for foul brood from a practical standpoint; but there is a scientific side that is both interesting and important; and for this I can do no better than to quote from that skilled microscopist, scientist, author, and bee-keeper, to whom I have already referred under Anatomy of the Bee, Thos. William Cowan, who is editor of the *British Bee Journal*. From his work, "Foul Brood and its Treatment," I make the following extracts:

LIFE HISTORY OF FOUL BROOD.

It will be necessary to give only a brief outline of the life history of *Bacillus alvei* to enable us to understand somewhat of the nature of this disease.

Bacillus alvei is a pathogenic or disease-producing micro-organism, in form cylindrical or rod-shaped, and increasing by splitting or fissuration. The rods increase in length without growing thicker, and at a certain point divide and separate in two, to again increase, divide, and separate. Sometimes, in suitable nourishing media, the lengthening of the rod is not accompanied by separation, but only by repeated division into longer or shorter chains of bacillus-filaments, or leptothrix. The rods are also provided with a flagellum at one end, and are endowed with the power of locomotion. Under certain conditions bacilli have the power of forming spores, in which case a speck appears at a particular point of the bacillus, which gradually enlarges and develops into an oval highly refractive body, thicker but shorter than the original rod. The spore grows at the expense of the protoplasm of the

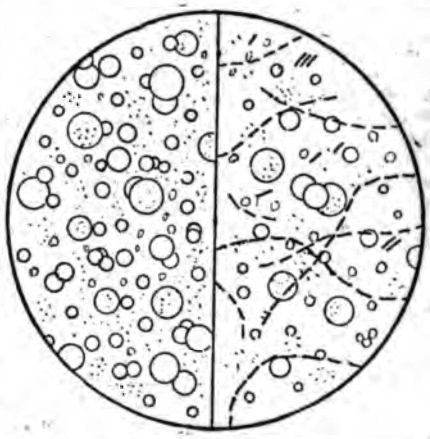


FIG. 2.—HEALTHY JUICES. FIG. 3.—EARLY STAGE.

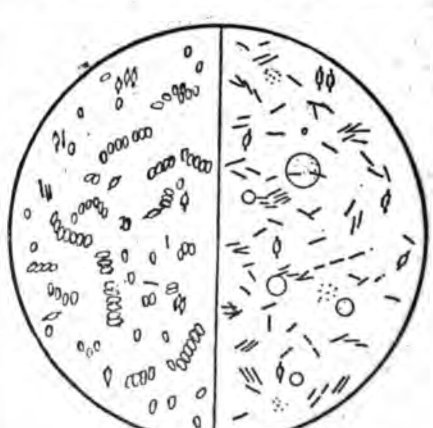


FIG. 4.—LATER STAGE. FIG. 5.—LAST STAGE.

cell, which in time disappears, setting free the spore. The latter formation closes the cycle of the life history of the bacillus. The spores—representing the seeds—retain the power of germinating into bacilli when introduced into a suitable nourishing medium, and at a proper temperature, even after the lapse of long periods of time. At germination the spore first loses its brilliancy, swells up, and eventually its membrane bursts in the middle. The

inner part of the spore then projects through the opening and grows to a new rod.

The spores also possess the power of enduring adverse influences of various kinds without injury to their vitality, so far as germinating is concerned, even if subjected to influences fatal to bacilli themselves. The latter are destroyed at the temperature of boiling water, while the spore apparently suffers no damage at that temperature. Freezing also kills the bacilli, but not the spores. In the same way chemical reagents, completely destructive of the bacilli, do not affect the vitality of the spores. Carbolic acid, phenol, thymol, salicylic acid, naphthol beta, perchloride of mercury, and many other substances, even when considerably diluted, prevent the growth of bacilli, but have no effect whatever upon the spores. The great resistance of spores to high and low temperatures, to acids and other substances, is due to their being encased within a thick double membrane.

There are certain chemical substances which evaporate at the ordinary temperature of the hive, and whose vapors, while not actually killing the bacilli, arrest their increase or growth. Among such substances are carbolic acid, phenyl (or creolin), lysol, eucalyptus, camphor, napthalene, and several others.

If a healthy larva be taken, and a small quantity of the juice from its body spread on a glass slide be placed under the microscope, we shall see a number of fat-globules and blood-disks (Fig. 2), among which molecules are in constant motion. If, on the other hand, a young larva diseased, but not yet dead, be treated as above, its juices will, when subjected to a similar examination, be seen to contain a great number of active rods swimming backward and forward among the blood-disks and fat-globules, which latter, as will be noticed (Fig. 3), are fewer than those in the juices of a healthy larva. We shall also find, as the disease makes rapid progress, chains of bacilli—the leptothrix form—becoming common. In Fig. 4 we have a representation of a later stage of the disease when the larva is dead and decomposing. Here the fat and albuminoids will be found disappearing, and the bacilli assuming the spore condition. In Fig. 5 we see the disease in its latest stage, when the whole rotten mass has become coffee-colored, or has dried to a scale. Blood-disks, fat-globules, and molecular movements have disappeared, only a few bacilli are seen, and at last, as the nourishing material becomes exhausted, only spores remain.

It will now be understood, that, owing to the great resistance of the spores, chemical substances have no effect at all upon them unless administered under such conditions as would destroy the bees. From this it will be seen how great is the difficulty in curing foul brood unless the disease is attacked in its early stages.

It has previously been stated that adult bees are sometimes attacked by the disease. To prove this, it is only necessary to take a weakly bee on the point of death, and examine what remains of its fluids under the microscope, when a large number of active bacilli will be found. Such bees leave the hive to die, whereas the infected larvæ remain in the cells, unless disinfectants to arrest decomposition are used, in which case the bees remove them from the hives.

A careful reading of the method as above will make it very apparent why we, in our large experience with foul brood, could not effect a *permanent* cure of the disease by the application of disinfectants in the form of carbolic acid, salicylic acid, and the like. While we could kill the bacilli themselves with the antiseptics we had no effect on the *spores*, which would hatch later on, and, as a consequence, give rise to the disease again. We found it absolutely necessary to burn the combs, frames, and sometimes the hives, when the case was a very bad one, and the combs fairly rotten.

Mr. Cowan's statements, based on his investigation with one of the best microscopes, agree exactly with our quite extensive *experience* with foul brood some years ago.

PICKLED BROOD.

There is another kind of diseased brood in many respects resembling foul brood, but lacking two important characteristics: (1) Ropiness, or stringiness of the dead matter; (2) the foul odor. In other respects it looks very much like it under some circumstances. But it more closely resembles black brood—so much so that it is difficult to tell one from the other. Pickled brood apparently comes and goes; is mildly contagious, and could not be really considered a destructive disease; that is to say, the bees will usually take care of it; and if not, a little assistance from the apiarist will bring it under control. There is not a doubt but that it has often been confounded for foul brood; and that is the reason why some remedies which were claimed to be absolute specifics for this destructive disease were tried on a mild malady that often goes off itself.

SYMPTOMS OF PICKLED BROOD.

Combs containing the disease in the more advanced stages look moldy. The larva dies, lies on its back, both ends pointing upward; often swollen, and, according to Mr. W. J. Stahmann, in the *American Bee Journal*, of Waverly, Minn., who has had much experience with it, it is at first white, and at such times is "hard to distinguish from live brood." At this stage, he says, "the bees generally remove it. If not removed, its color changes to a yellow, in a few days getting darker until it is nearly black. In some cases it is allowed to dry in the cells. It is very watery after it is colored, not at all ropy or sticky, and emits no foul odor. . . A colony may have only a few cells of dead larvæ, and keep them removed, so that it is

hardly noticeable at times; then they may make a turn and not remove it. This seems to cause it to increase very rapidly, and many more die than if they kept it removed. . . I have had some colonies that have shown considerable dead brood all summer, with no perceptible increase or decrease. . I am of the opinion that when bees have contracted this disease it never leaves them permanently. . . I believe that some of my colonies have had this disease for several years without my noticing it, and that I have spread it in my apiaries by changing combs. . . As an experiment tending toward a cure I selected one colony that was badly infected; took away all their old combs, and gave them new frames with foundation starters only. So far I can find no trace of the disease." When the bees are not able to cure the disease themselves, it can be readily removed by this plan, or what is known as the starvation method described for the treatment of foul brood, just preceding. In any event, if one is not certain whether he has pickled brood or something else, he had better err on the safe side, and shake the bees on foundation at once. Do not take any chances; and remember that pickled brood resembles black brood much more closely than it does foul brood; and, as we shall presently see, black brood is as much to be feared as foul brood, so that the average bee-keeper had better treat every case of diseased or dead brood just as if it were foul brood or black brood.

Dr. Wm. R. Howard, an expert bacteriologist of Fort Worth, Texas, was the first one to recognize pickled brood and give it a specific name. It was he who first drew attention to the fact that this disease was not due to bacillus but to a fungus growth. He has named it, therefore, pickled or white fungus disease. In 1896 he published in the *American Bee Journal* quite an elaborate description of it, and this we have thought best to place before our readers in permanent form. He says:

My attention was called to this disease nearly two years ago. I had two colonies to die during the winter, and, when examined in the spring, I found the combs very moldy, especially those containing pollen. These combs were given to other colonies, and every thing went off nicely till the brood was about ready to seal, when much of it was found to be dead. Careful watch was kept, and it was noted that the dead brood did not decay like "foul brood." Again, much of that which was sealed never hatched, and was found to be dead and shriveled, without becoming rotten. The season was a poor one, little honey coming in, the bees seemed discouraged, uneasy, and often the dead white larvæ would be carried out. On examining the combs the dying larvæ were noticed to be wriggling out of the cells. Some were only half way out, but fell out while under observation.

The larvæ when dead have a swollen appearance. Neither end touching the sides of the cell is a common position (Fig. 5 *a*). In some cases, when left five or six days, the brood settles down like "foul brood" (Fig. 5 *b*), and changes to a dark-brownish mass, which, on examination, is found to be watery, and not "ropy" like "foul brood;" entirely void of the offensive odor; in fact, no odor at all.

A microscopical investigation showed, in addition to *Penicillium glaucum* (Fig. 1 *d*), other molds in the pollen and on the combs; from these and the dead brood was isolated as the cause of the trouble a species of *aspergillus*, a white fungus, or mold. Several experiments were made during the summer, which fully satisfied me that my conclusions were correct.

This suggested to my mind, that perhaps this was the kind of "foul brood" of which so many had written—the kind which had been treated by the *starvation method*, the *drug method* (?), and the kind which always disappears as soon as *fresh pollen* comes in; and possibly the kind mentioned by Mr. N. W. McLain (author's "Foul Brood," page 34), which he found to attack the brood when the first feeding of pollen takes place. This trouble has been mentioned by many writers in the bee-papers, and many questions propounded by my correspondents regarding its nature and cure. I have recommended, with successful results, placing the bees on full sheets of foundation, confining them for three days (giving them plenty of water) in order to consume all of the infected material, that none of it might be deposited in the new combs to be covered with new pollen or honey. The disease is infectious, and may be carried by robbers having access to infected combs.

Pollen is a favorable medium, and the warm, damp, dark cellars in which bees are wintered in the Northern climate, give the proper conditions for the growth and moldy combs result.

When pollen is added to the liquid food, which occurs late in larval life, there being a sweet semi-liquid mixture, the proper medium is present for the growth of the fungus, which at once starts a ferment in the alimentary canal of the larva, breaking through and permeating the entire liquids of the body, giving an acid reaction (chemical analysis proves the presence of acetic acid, or vinegar). This growth takes place generally within three days, the brood dies slowly, keeping up for some time a wriggling motion.

When no more food (sweets) is taken, the medium is soon exhausted and the fungus ceases to grow; the acid condition of the brood prevents the growth of the putrefactive germs from the air, so that decomposition does not take place, hence no foul odor. The brood is *pickled in its own liquids.*

WHITE FUNGUS—*Aspergillis Pollini.*

A mold introduced to a healthy colony from moldy combs or pollen (Fig. 3), which when mixed with the liquid food composed mostly of honey and water, a ferment takes place, and vinegar is formed in the stomach of the bee, the combined action of the mold and the ferment destroys the life, as above mentioned.

SYMPTOMS AND COURSE.—Brood is attacked only after the pollen is mixed with the liquid food, and dies just before arriving at the pupa stage, generally; sometimes passes into this stage and is sealed. No brood dies before the age of feeding mixed food arrives. The dead brood being in an acid or pickled condition, it is not attacked by the putrefactive germs

from the atmosphere. No decomposition takes place, there is a watery (not ropy) condition of the brood when broken up, sometimes of a light-brown color, generally white, giving off *no odor*. The cap in sealed brood is not ruptured (Fig. 6, *a*). The dead brood has a swollen appearance (Fig. 5, *a*), and when dry does not stick to the comb or cell, and often does not lose its shape.

When *Aspergillis pollini* (Figs. 3 and 4) is planted with the combs in water, or the brood on plates partially submerged in sweetened water mixed with starch or wheat-bran, placed in a moist chamber in a dark room, growth at once takes place, and in 3 or 4 days covers the medium, converting it into an acid solution. When exposed to the air putrefactive germs do not attack the culture.—Ft. Worth, Tex.—From *The American Bee Journal*.

BLACK BROOD.

In 1898, '99, and 1900 there appeared a peculiar form of malady apparently affecting the adult bees as well as the brood throughout the eastern portions of New York. At first many thought it was foul brood. Others came to the conclusion that it was pickled brood; and still others felt very sure it was neither. It differed from both in some important characteristics. It was fully as destructive as foul brood, and did not yield readily in all cases to the treatment prescribed for that disease.

Dr. Wm. R. Howard, to whom reference has already been made, Professor of Histology, Pathology, and Bacteriology of the Medical Department of Fort Worth University, Fort Worth, Texas, who had already given considerable study and attention to the subject of foul and pickled broods, was finally prevailed on to undertake an exhaustive study of this new malady that was making such dreadful havoc among the bees in New York. Possessing one of the finest and most expensive microscopes, and having all the very latest and best apparatus of a well-equipped laboratory, he began his studies and investigations in the fall of 1899, and concluded them in February of the following year, at which time he issued a bulletin giving a full history and pathological characteristics of this new disease, for indeed it proved to be such. He named it the New York bee-disease, or black brood. The last name has been adopted by bee-keepers in general.

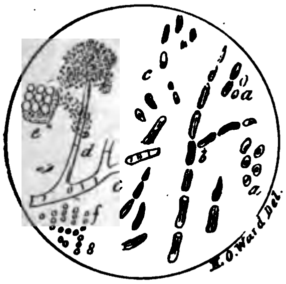


FIG. 1.

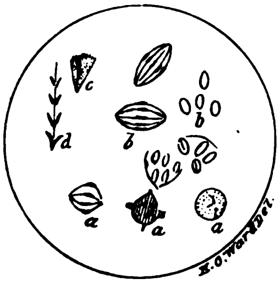


FIG. 2.

FIG. 3.

Fig. 1.—Bacillus alvei and other germs—600 diameters. [Figures from the author's "Foul Brood."]
Fig. 2.—Pollen-grains, etc.—600 diameters. [Figures from the author's "Foul Brood."]
Fig. 3.—Infected pollen—600 diameters. *a*, globular and polyhedral pollen-grains; *b*, resting spores found in bee bread and in larvæ; *c*, growth three days' old, as found on proper culture media, also in the body of the larvæ; *d*, division of the resting spores; *b*, when growth first starts.

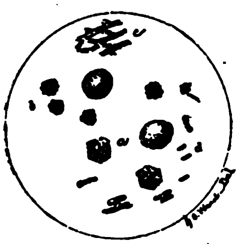


FIG. 4.

FIG. 5.

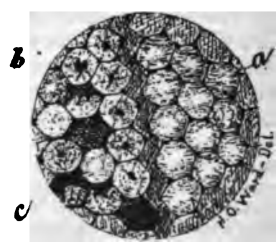


FIG. 6.

Fig. 4.—The mature mold—600 diameters. *e*, the network of the base (mycelium) of the mold; *f*, the resting spores; *g*, the threadlike filament, running and branching in every direction, containing spores within the threads as well as outside.
Fig. 5.—Contrast between the white-fungus disease and foul brood—profile, natural size. *a*, dead or pickled brood from the white fungus; *b*, dead brood from foul brood.
Fig. 6.—Difference between normal caps, or those over the white fungus, and foul brood—surface, natural size *a*, white fungus, or normal; *b*, caps with the ragged hole near the center as found in foul brood; *c*, partially removed cap showing the mass within.

Dr. Howard made more than a thousand microscopical examinations; inspected dozens of samples of the dead brood that were sent from New York and other States, so that he had all the material he could reasonably require for his investigation. As a result of his researches he found a new and distinct form of bacterium, or, rather, two forms, the most prominent of which were *Bacillus milii* and *Bacillus thoracis*. The former was so named from its resemblance to millet seed, and the latter because it was found in the thorax or spiracles (air-passages) of the bees. In many of the samples he found both of these germs, and in some others only the *Bacillus milii*. From an extended correspondence he learned that this disease attacks probably the adult bees as well as the brood, and that it seems to be most active in the sealed brood of the pupa stage. The younger larvæ, while they may have the destructive germs in their alimentary tract, are not usually immediately affected. As they grow older, symptoms of the disease begin to appear. But they still live, and continue growing until they reach the pupa stage, when they will turn black, and die—hence the term "black brood." At about this stage there is apt to be a penetrating sour smell, quite unlike the sickening odor of foul brood.

I show on p. 160 some microscopic slides showing a variety of forms of bacteria and fungi which Dr. Howard discovered in the diseased specimens that were submitted to him, but only two of which — *Bacillus milii* and *Bacillus thoracis*—are in any way directly connected with the disease known as black brood.

SYMPTOMS OF BLACK BROOD.

I can do no better than to quote from Dr. Howard's report on page 7 of the aforesaid bulletin.

SYMPTOMS AND COURSE.

Brood is usually attacked late in the larval life, and dies during pubation, or later when nearly mature and ready to come forth through the chrysalis capping. Even after leaving the cell they are so feeble that they fall from the combs helpless. Most of the brood dies after it is sealed. In this it is much like pickled brood, except that as much or more brood dies in the late larval stage than in the pupa. In foul brood, while brood of all ages dies, yet more dies "at the ages of 6, 7, 8, and 9 days than at any other age" (author's Foul Brood, p. 46), even before the rich chyle-like food mixed with pollen is given, which is such a necessary environment for pickled brood and *black brood*.

When the larvæ show the first signs of this disease, there appears a brownish spot on the body, about the size of a pinhead. The larvæ may yet receive nourishment for a day or two; but as the fermentation increases the brownish spot enlarges, the larva dies, stands out, swollen and sharp at the ends. In this they are like pickled brood, except that the brown spot is not present in pickled brood, but pickled brood sometimes becomes brown after death. Foul brood turns brown only after the action of putrefactive germs have brought about decomposition. No decomposition from putrefactive germs takes place in pickled brood. In *black brood* the dark and rotten masses, in time, break down and settle to the lower side of the cells, as a watery, syrupy, granular liquid—not the sticky, ropy, balsam or glue-like semi-fluid substance of foul brood. It does not adhere to the cell-walls like that of foul brood; has not the characteristic foul odor which attracts carrion-flies, but a sour, rotten-apple smell, and not even a house-fly will set her foot upon it. Cappings in foul brood are sunken in the center when broken, sometimes puffed out by internal gases. In *black brood*, the cap is disturbed from without, sometimes uncapped, and cell contents removed by the bees; not so in foul brood. The cap in pickled brood is usually undisturbed. The decayed brood masses do not adhere to the cell-walls like either of the others.

During a good honey-flow, of a few weeks' duration, if the colonies are strong, *black brood* and pickled brood entirely disappear so far as appearances go; and even in foul brood, colonies seem for the time to improve. The most common causes for this apparent improvement are that in *black brood* and foul brood the old foul combs are filled with honey instead of brood; and eggs are laid in cells hitherto not used for brood, and in new combs when comb-building is going on; or where comb-foundation is used, the queen takes advantage of this and deposits her eggs before the cells are drawn out and filled with honey. Again, proportionately, there is less brood-rearing and more comb-building during a heavy honey-flow in strong colonies than in weak ones. In weaker colonies these diseases do not disappear, as more brood is reared and less comb is built, in proportion to the mature bees, than in strong ones. In pickled brood the infection is in bad pollen; nice new pollen always causes it to disappear. Why these diseases should recur when there is a dearth of honey in the field, would be of interest to many.

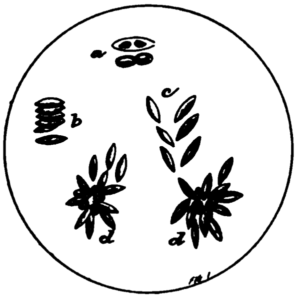
In strong colonies, as we have seen, proportionately less brood was reared during the honey-flow, and now we have fewer bees to keep up the strength of the colonies against the normal death rate. Again, the brood is gradually finding its way back to the center of the brood-nest, where there are many infected cells which were filled with honey during the rush of the honey-flow. These, with inclement weather and other unnatural surroundings, are conducive to recurrence. Often new pollen is stored on old infected pollen—in the same cell—and when this new pollen is exhausted, and no other to be had, the old pollen must be used; hence a recurrence of pickled brood.

TREATMENT.

The best time to effect a cure is during a honey-flow. Adopting a modified McEvoy plan:

Make your stocks strong by uniting; place them upon comb-foundation starters, and cage the queen After five days remove the starters and make them into wax, and give full sheets of foundation—keeping the queen caged five days longer. This will give time for all infected mature bees to have disappeared before any brood is reared.

Don't try to save infected mature bees by drugs. They are not worth the trouble; yet salicylated



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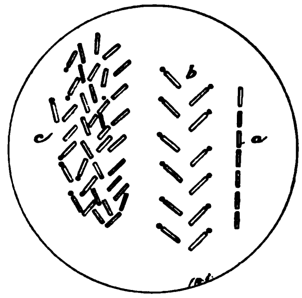

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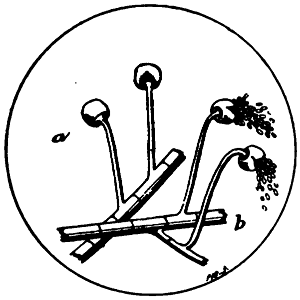

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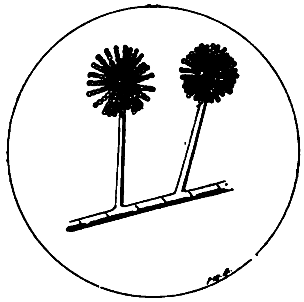

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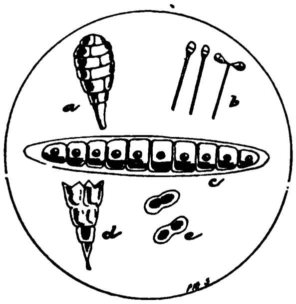

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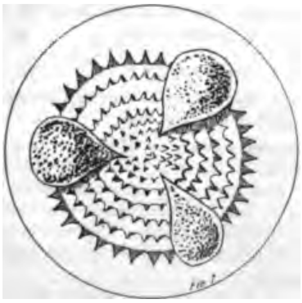

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syrups,* during a dearth of honey in the field, would in a measure prevent a recurrence, but would not cure the disease. It would not destroy the germs, but prevent their growth, by placing them in an antiseptic† medium.

If a cure is contemplated when little honey is coming in, the above modified McEvoy plan should be observed in every detail, and the bees fed with salicylated syrups until the combs are well filled, so that all food may be rendered antiseptic by the time brood-rearing begins.

Great care should be taken to melt all old combs and removed starters into wax at once. Do not use a solar extractor, but remove the material at once to hot water or a steam-extractor. Until further investigations shall reveal the longevity of these germs in open air, I shall recommend a thorough disinfection of the hives, frames, etc., by boiling in linseed oil for half an hour. This would not injure hives or fixtures; besides, the high temperature reached would insure thorough disinfection. Careful, practical, and experimental work, coupled with microscopical investigations in the presence of this disease when at its worst, will, I feel confident, discover some practical plan for its successful eradication.

DIFFERENTIAL DIAGNOSIS.

Foul brood, pickled brood, and black brood. Foul brood, due to *Bacillus alvei*—a specific bacterium.

Pickled brood, due to *Aspergillus pollinis*—a specific fungus.

Black brood, due to *Bacillus milii*, modified, perhaps, by *Bacillus thoracis*, specific bacteria.

Black brood may be introduced into a healthy colony through infected food or infected combs—combs from which the diseased brood has been removed, or in which particles remain. The food for the young larvæ, either from its chemical reaction or from its lack of nitrogenous substances, is not a suitable medium for immediate growth of the germs; but when the chyle-like food is furnished the older larvæ, a chemical change in the food produces a change in the liquids of the bee, which become a suitable nutrient medium for their rapid development and dissemination. It would appear that, in some cases, *Bacillus thoracis* was the cause of death, as the spiracles, or openings admitting air to the respiratory apparatus, were closed by the products of decomposition or the result of it. In such cases it is usually nearly matured bees that are choked for want of air. These did not show the discoloration or shapeless mass which always obtains when *Bacillus milii* is found in the abdomen. This latter germ, multiplying rapidly in the rich nutrient medium of the alimentary tract, may destroy younger brood than the former. It is often found in other parts, and is certainly the cause of the dark masses of rotten brood. Both germs are found in the same comb, and often in the same bee, thus insuring a mixed infection.

As between the two diseases (black and foul brood), from what I have learned I am inclined to think that the former is more to be feared. As to cure I would recommend that Dr. Howard's treatment as described by him be followed. But the foul-brood inspector of New York assures me that the simple McEvoy plan as given for foul brood has worked very nicely, *providing* that the directions were carefully followed, and every thing including hives were disinfected. The greatest trouble will arise in determining whether the diseased sample up for consideration is pickled or black brood. Desiring to get further information, so that the two might be distinguished, I wrote to Dr. Howard and received the following reply:

FOUL BROOD.

Glue-like consistence of the mass, and the offensive smell.

BLACK BROOD.

Jelly-like consistence of the mass, the absence of ropiness noticed in foul brood, and the peculiar sour-like smell.

PICKLED BROOD.

Always watery, turning black after being attacked with the mucor fungus—a black mold—and by placing the larvæ in a sterilized chamber, keeping warm and dark, in three or four days the white fungus of pickled brood appears. WM. R. HOWARD.

EXPLANATION OF PLATE; MAGNIFIED 600 DIAMETERS—REDUCED.

Fig. 1.—*Bacillus milii*. *a*, spore formation, showing morphological changes, in agar-agar-plate culture; *b*, peculiar arrangement often noticed in cultures; *c*, isolated bacilli, floating in the liquids of the bee or in cultures; *d*, Zooglea, showing the most common arrangement of the spores at the center, and the separation of the bacilli from the mass.

Fig. 2.—*Bacillus thoracis*, *a* showing rods arranged end to end as occurs in cultures; *b*, peculiar arrangement seen in agar-agar drop cultures, showing spores by fission; *c*, Zooglea, showing common arrangement of the mass.

Fig. 3.—Mucor, *a* showing the spore-bearing heads; *b* showing these heads discharging the spores. Common on decaying matter.

Fig. 4.—*Aspergillus pollinis*, the fungus causing "Pickled Brood."

Fig. 5, *Fungi*.—*a*, *Hendersonia polycystis*. Fungus found on dead twigs, grasses, etc.; very common; *b*, *Dactylium roseum*, appears as pinkish roseate spots on decaying vegetation; very common; *c*, *Massaria*, var. *d* and *e*, fungi not common—not placed: unimportant.

Figs. 6 and 7, spore-bearing organs of fungi.

Fig. 6, *a*, transparent spore-receptacle intact; *b*, same, showing membrane ruptured and spores escaping.

Fig. 7.—Contains similar spores in size and shape, which escape through the membranous pouches triangularly arranged at the dentate periphery. Found in pollen. No culture made.

Fig. 8.—*Penicillium glaucum*, common fungus, found on moldy bread and elsewhere; very common.

FOUNDATION. See COMB FOUNDATION.

FRAMES. See FIXED FRAMES, REVERSING, and HIVES.

FRAMES, HOW TO MANIPULATE. Under FIXED FRAMES I showed that there are two kinds in use—the fixed and the loose frame; and as the latter is more generally used, I will describe this first. In the first

* Sodium salicylate one ounce, water five gallons, white sugar forty pounds. Make syrup without heat.

† Antiseptics prevent germ growth. Disinfectants destroy the life of germs by actual contact only.

place, I assume that the learner has a smoker and a bee-veil. The smoker should be well going. For directions how to light, see SMOKERS. Approach the hive that is to be opened, and blow a little smoke into the entrance. If there is no enamel cloth under the cover it will be necessary, of course, to pry it loose with a knife or screwdriver, as it will be fastened down with propolis. Just the moment the cover is loosened, blow the smoke through the crack; and while the cover is being lifted off blow more smoke over the top of the frames. Do not use too much, but enough to quiet the bees. If they are hybrids it will be necessary to use more than for pure Italians, as a matter of course. The moment the cover is off turn it up edgewise, and sit down on it, milk-stool fashion, as shown in Fig. 1.[431]

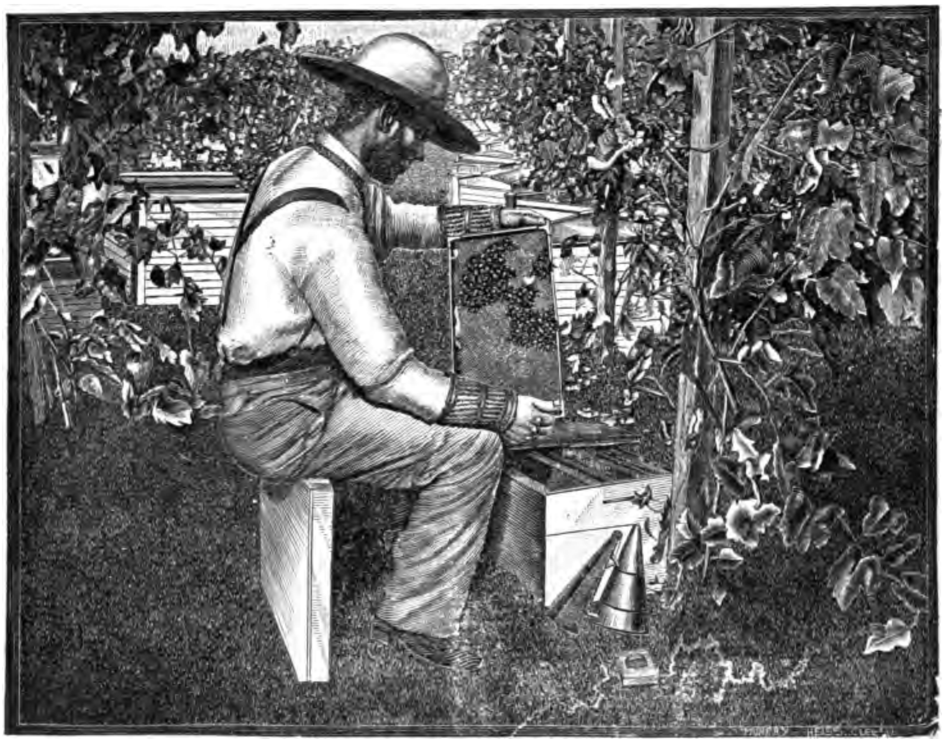


FIG. 1—HOW TO SIT ON HIVE-COVER.*

To get at the center frame, crowd the frames, one at a time, adjacent to it, toward the sides of the hive. This will give room to lift out the frame sought for. Beginners are pretty apt to pull the frame out without spacing the frames apart. This rolls the bees over and over, enrages and kills them, besides running a pretty good chance of killing the queen. Lift the frame out carefully, and be careful not to knock the end-bars against the sides of the hive. If it is one's first experience he may be a little nervous, and do things a little hurriedly. As a reward, the bees will quite likely sting him and make him still more nervous. To avoid this, proceed very cautiously and make the movements deliberate. Having removed the frame, hold it up before the eyes, as shown in Fig. 2, which we will call the first position.

Perhaps the queen is not to be seen on this, so it may be necessary to turn it over and see the other side. If the comb is heavy with honey, it can be turned right over with the bottom-bar resting horizontally. But a better way and a good habit to fall into, and one that good bee-keepers usually adopt, is this: Raise the right hand until the top-bar is perpendicular, as shown in Fig. 3.

Now revolve the frame like a swinging door, or the leaf of a book, so that the opposite side is exposed to view. There is a little knack about it; and to become familiar, take a frame without any bees on it, and

* For further description of this cut, see VEILS.

try a few times until you become familiar with this mode of handling.[435]

Having examined this frame, lean it against the side of the hive, and remove one

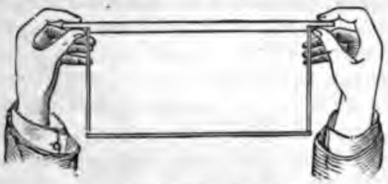


FIG. 2. FIRST POSITION.

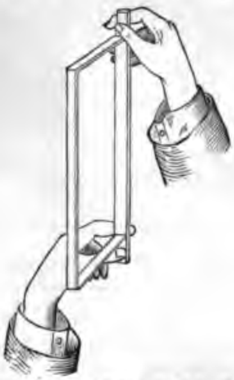


FIG. 3. SECOND AND THIRD POSITIONS.

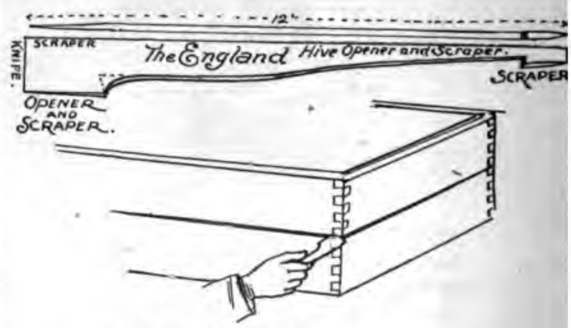
of the frames next to the one already removed. Examine this in like manner. Lean this also against one corner of the hive, or return it to the hive; lift out another, and so on until the whole number has been examined. Now, perhaps the queen has not been found yet. Look the frames all over again, and be careful to look around the bottom edge of the combs.

If a colony is not populous it may be advisable to go over the frames once more: but very often it is better to close the hive up and wait an hour or two, after which we can go back and look over the frames as before. By this time the colony will have recovered itself, and the queen will, in all probability, have shifted her position from the bottom or sides of the hive to one of the frames. Nine times out of ten she will be found at the second going-over of the frames, without any trouble. If the queen can not be found the first time going over, as a rule I would not advise hunting longer, because one is liable to waste a good deal of valuable time, and it is, therefore, better to wait till the queen gets out of her hiding-place on to the brood-frames themselves.

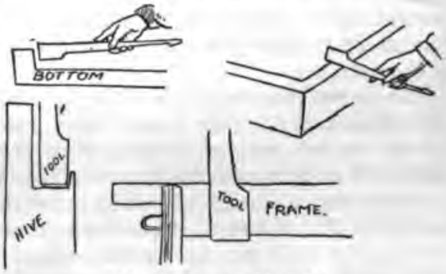
In the case of black colonies, and where especially if very populous, it is sometimes necessary to lift the hive off its stand and set it down to one side. On the old stand place an empty hive, putting on it an entrance-guard. See DRONES. Now take the frames one by one out of the old hive, and shake them in front of the entrance of the empty hive on the old stand. The black bees will fall off very readily; and as they crawl toward the hive the queen can be very easily seen; but if she eludes scrutiny she will be barred by the perforated zinc, where she may be very readily discovered trying to make her way through. If, after all the frames are shaken, she can not be found, then take the old hive, now empty, and dump it, causing the bees to be thrown before the zinc. She will soon be seen trying to pass the guard.

I have told how to find the queen; but one must not imagine that it is going to be as difficult as this every time. She will most likely be found on the center frames, as a general thing; and especially with Italians, she will likely be found on the first or second frame.

When we put back the loose frames, we must space each one carefully, as nearly as we can, $1\frac{3}{8}$ in. from center to center. We can not do it exactly, but do it the best we



ENGLAND'S HIVE-TOOL.



MANNER OF USING.

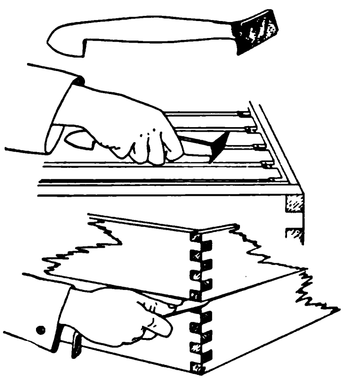
can. With loose frames we shall be obliged to space each frame in position individually. If we do not space our frames carefully we will have some combs bulged, and some thin-

ned down ; and, again, between others bees will be likely to build spurs of comb. All this nuisance may be avoided by the use of fixed frames or the Hoffman, which I will now tell how to manipulate next.

HOW TO MANIPULATE HOFFMAN FRAMES.

One of the conveniences, and almost necessities, is a screwdriver. This, or (what is better), tools like those shown in illustrations here and on the preceding page, can

be made at any blacksmith shop, and is handy for scraping as well as prying. Of the three shown I prefer the England tool. It is a hook, a screwdriver, a scraper, and a



pry all combined. The *broad thin* blade on one end makes it possible to separate the two parts of a hive without marring the wood at the point of prying as does a screwdriver or other blunt narrow-headed tool. With this or a tool of some sort I pry loose the flat board cover of the Dovetailed hive, having previously blown a little smoke in at the entrance.

The cover removed, I place the same under me, and sit down on it, milk-stool fashion (as in cut), and as illustrated on next page. It will be noticed that the cover is a seat on which we can lean backward and forward. This I find a great convenience, in that the body can be leaned toward or from the hive; and, the elbows resting on the knees, they can support quite a heavy weight in the way of two or three Hoffman frames.

A little smoke is blown over the top of the frames. The follower, or spacing-board, is next removed, and leaned against the hive opposite to where we are sitting (see cut). With the hive-tool we pry apart the first pair or trio of frames, if the frames are not too heavy, and lean them against one corner

FIG. 5—MANNER OF CROWDING HOFFMAN FRAMES TOGETHER.

of the hive as shown above. By so doing we pretty nearly handle the brood-nest in halves and quarters.

We shall discover that these frames are held together by propolis, and that the bees on the two inside surfaces are hardly disturbed. The loose frames, on the contrary, when out of the hive, must be leaned on one or two corners of the hives, against each other—in fact, be scattered all around for the depredations of robbers; and, besides all that, the liability of killing bees or the queen is much greater. This is quite a point in favor of the Hoffman frames. If

FIG. 6—HANDLING HOFFMAN FRAMES IN PAIRS AND TRIOS.

we do not find the queen on the frame in hive, we next pry off the outside frame of a trio leaning against the corner of the hive. If she does not appear on that one, we pry off the next one, and so on.

If frames are heavy with honey, we may lift out only one frame. Having seen the surfaces of two or three combs, the practiced eye will get a pretty fair idea of the condition of the colony and what the queen is doing. If we see eggs and larvæ in all stages, as well as sealed brood, we do not usually stop to hunt up the queen; accordingly we put back the second pair removed, and return the trio, as shown in Figs. 4 and 5. We do not generally crowd these frames together at once. We blow a little smoke down between each of the end-bars, and then with a quick shove we close them all up again.

FIG. 4. HANDLING HOFFMAN FRAMES.

There is no cut-and-try spacing as with loose frames—no big and little fingers to get the distances at wide and narrow spaces. There is no need to instruct the beginner on just how far to space combs, and there is no finding the apiary afterward, with the combs spaced so far apart that spurs of comb are built where they ought not to be. With the regular Hoffman frames the spaces must necessarily be exact, and the combs will have a fixed and definite thickness; and I do not hesitate to say that one can alternate them just as well as, and even better than, he can many of the loose frames. Let me explain. Space the loose frame during the honey-harvest, anywhere from 1⅜ to 1½ or even 1¾ inches from center to center, and then, after the honey-harvest, try to alternate it with other frames placed a little closer, and see where you are. You may say you can space frames near enough right. Although I have visited many large apiaries, I never saw a loose-frame apiary spaced near enough right, unless it was Mr. Manum's home apiary. He is one of those precise men who are bound to have every thing just so.

Well, now, then, we will replace the follower, and crowd the frames tight together. If there are any bees on the tops of the frames, a whiff of smoke will usually drive them down, and then the cover is replaced with a sliding motion, which I have already explained.

Perhaps from my description about manipulating the hive with Hoffman frames, it may appear like a long operation; but I can assure the reader that it is a very short one. Mr. Hoffman* says he can handle nearly

*See BIOGRAPHICAL SKETCHES.

double the number of colonies on his frame that he could on any loose frame; and I will add right here, that he used loose frames for years, until necessity, the mother of invention, caused him to bring out this style.

There is another good feature; namely, by removing two or three frames in a trio, the rest of the frames in the hive need not be lifted out. They can be slipped back and forth, and each surface examined; but if the tin rabbet is covered with pieces of propolis, this lateral sliding is not easily accomplished.

As will be explained under HIVE-MAKING, there are some localities where propolis is very much worse than in others. In such places the Hoffman frame is not as satisfactorily used as the staple-spaced shown in HIVE-MAKING. With perhaps one exception this can be handled like the Hoffman; and that exception is that it can not be handled in pairs or trios. Each comb must be manipulated individually. In this respect it is quite a little behind the Hoffmna.[439]

FRUIT-BLOSSOMS. In the northern portions of the United States, where much fruit is grown, especially apples, pears, and peaches, there will be an occasional spring when quite a little honey will be gathered from the blossoms. Nearly every season fruit-trees yield a little honey, if not too cold, just when it is most needed to stimulate brood-rearing; and although the bees may not store much, they will gather enough to give the whole apiary a new impetus, so that, in a region where fruit is grown extensively, bee-keepers often receive considerable benefit.

As to the quality, the honey from fruit-blossoms is among the very best. It is light in color, of good body, and in flavor not unlike the beautiful aroma one smells when going through an orchard in full bloom. Such honey, if it could be gathered in sufficient quantities, would doubtless have an extensive demand: but it is very seldom one is able to get enough to enable the bees to store in the supers or in sections.

SPRAYING DURING BLOOM DESTRUCTIVE TO BEES AND BROOD.

Now that spraying with various poisonous liquids has come to be almost universal among fruit-growers, the question arises, "Shall such spraying be done during the time the trees are in bloom, or before and after?" If it is administered when the petals are out, the bees are almost sure to be poisoned. Much brood will be killed, and many times valuable queens are lost. About the first thing one notices during fruit-blooming time, if trees are sprayed while in bloom, is that a good deal of the brood will die, and he will begin to wonder whether he has foul brood, black brood, or pickled brood, unless the truth dawns upon him that his bees have been carrying in the poisonous liquids from the trees that have just been sprayed. Experiment stations all over the United States have shown that it is quite useless—indeed, often decidedly harmful to the young fruit — to spray during the time the trees are in full bloom; and they have shown over and over again that just as good and better results can be secured by spraying both *before* and *after* blooming, and when there is no danger of bees visiting the trees in quest of pollen and nectar. Some experiments that were conducted at the Cornell and Geneva experiment stations, New York, are particularly conclusive in showing that spraying in full bloom was decidedly injurious to the blossoms themselves, to say nothing about the great damage done to the bee-keeper. The poison as it is ordinarily used is very harmful to the growth and development of the pollen. Again, the delicate organs of the flowers (stamens and pistils) are either killed or injured. Some of the pollen in the experiments above mentioned was taken into the laboratory and mixed with a thin syrup of about the consistency of raw nectar, and to this was then added a quantity of the spraying-liquid of the strength that is ordinarily used on fruit-trees. In every case it was found the pollen failed to develop. In short, those in charge of these experiments gave any amount of proof to the effect that, irrespective of any interests of the bee-keeper, the fruit-grower himself *could not afford to spray during fruit-blooming time, because spraying-liquids that are sufficiently strong to kill the insect pests are decidedly harmful to the delicate reproductive organs and to the pollen of the flowers themselves.*

Some prominent fruit-growers who once were of the contrary opinion, and who sprayed during full bloom, have since found to their sorrow their mistake. In some instances they confessed to losing nearly one thousand dollars. There are, however, certain parties who are interested in selling spraying-outfits who seem disposed to recommend spraying during fruit-blooming time, and who, through their extensive advertising, are doing a great damage to the bee-keeping industry. But none are so blind as those who will not see.

In a number of States laws have been enacted making it a misdemeanor to spray during blooming-time; but there are many ignorant fruit-growers—stubborn as well—who persist in administering the poisonous mixtures on the very flowers on which the bees are gathering pollen and nectar. The result is, many bees are killed, and a great deal of brood; and the only thing that can be done when there is no law in force is to labor with neighbors and friends who may be ignorant of or indifferent to the rights of others. Show them that the use of the arsenites during the flowering of the trees is a waste of chemicals, a waste of time, and a very great damage to the bees and to the bee-keeper, if not a menace to human beings who might eat of the honey tinctured with the poisons that bees gather from the trees. Much more can be done by moral suasion than by big talk and bluff, threatening suit for damages.

The first thing for the bee-keepers of any State to do, where there is no anti-spraying legislation, is to see that a law is enacted at the next session of the legislature. The members of both the upper and lower houses should be deluged with literature from experiment stations; and then when the bill comes up for passage some one should be present to see that it is not what is called "killed in committee" nor voted down from sheer lack of interest or of the knowledge of the great importance of the measure. Be careful to show that the proposed law is not to prohibit spraying entirely, but only at such times when it endangers life and property.

The appearance of poisoned brood is very much like that of pickled and black brood. It is never ropy, the brood is often of a whitish and sometimes grayish and sometimes brownish color. There is no way by which such dead brood can be detected from any diseased brood except by the microscope, or by applying to some chemist who can analyze the fluid juices of the dead larva, and thus determine the presence, if any, of poisons.

AGENCY OF BEES IN FERTILIZING FRUIT-BLOSSOMS.

At various times bee-keepers and fruit-growers have come into conflict, the latter affirming that the bees puncture the ripe fruit, besides interfering more or less during its packing; and the consequence is, that bee-keepers have in some cases been asked to remove their bees, on the ground of a nuisance. But the fruit-growers little realized that they were trying to drive away something that was necessary to the proper fertilization of fruit-blossoms. I am happy to say, however, in later years the two factions are beginning to realize that their industries are mutually interdependent. If any thing, the fruit-grower derives very much *more* benefit from the bees than the bee-keeper himself; for it is now known, as we shall presently show, that certain kinds of fruit not only depend very largely for their proper development upon the agency of the bee, but in many instances will fail to come to fruitage at all without it. Some years ago a bee-keeper in Massachusetts was obliged to remove his bees to another locality, on complaint of the fruit-growers that they were a nuisance; but after a year or two had passed they were very glad to have the bees back again, because so little fruit was set on the trees in proportion to the amount of blossoms appearing. The upshot of it was, that the bee-keeper was recalled; and, as was to be expected, not only more fruit but more perfect fruit development followed.

It is also related that red clover, after being introduced into Australia, failed to bear seed. Finally bumble-bees were imported, and then there was seed.

In more recent years, very careful and elaborate experiments have been conducted by scientific men, as well as by bee-keepers and fruit-growers together; and the testimony shows almost conclusively that the two industries depend more or less upon each other.

Much has been written in the back volumes of *Gleanings in Bee Culture* on this question; but in the journals for January 15 and February 15, 1894, there appeared a symposium in which a few of the facts were collated together. It would be impossible for me to give space to the whole; and I will, therefore, refer to only a few paragraphs. It may seem almost unnecessary to give evidence of that which we already *know* to be true; but many a time ignorant prejudice on the part of fruit-growers causes trouble, because they can not, or think they can not, afford to read the papers; but if the bee-keeper can present to them a few *facts and figures* they will, if disposed to be fair, acknowledge their mistake.

Well, here are the facts! In *Gleanings in Bee Culture* for Sept. 15, 1891, there appeared a most valuable article from the pen of Prof. A. J. Cook, professor of entomology,

then of the Michigan Agricultural College, detailing the experiments that had been made at that place on the subject of this fruit-fertilization question. He goes on to say that, while there are solitary insects that help to do this pollen-scattering, the work they perform is infinitesimal as compared with that of the bees, because, unlike the bees that live over winter, they are not present in early spring, when the fruit-trees are in bloom. After calling attention to the fact that it is important, by definite experimentation, that we learn just how necessary the bees are in the pollenization of plants, he says:

I tried many experiments last spring. I counted the blossoms on each of two branches, or plants, of apple, cherry, pear, strawberry, raspberry, and clover. One of these, in case of each fruit or each experiment, was surrounded by cheese-cloth just before the blossoms opened, and kept covered till the blossoms fell off. The apple, pear, and cherry, were covered May 4th, and uncovered May 25th and May 19th. The number of blossoms considered varied from 32, the smallest number, to 300, the largest. The trees were examined June 11th, to see what number of the fruit had set. The per cent of blossoms which developed on the covered trees was a little over 2, while almost 20 per cent of the *uncovered* blossoms had developed. Of the pears, not one of the covered developed, while 5 per cent of the uncovered developed fruit. Of the cherries, 3 per cent only of the covered developed, while 40 per cent of the uncovered blossoms set their fruit. The strawberries were covered May 18th, and uncovered June 16th. The number of blossoms in each experiment varied from 60 in the least to 212 in the greatest. In these cases, a box covered with cheese-cloth surrounded the plants. The plants were examined June 2d. Eleven per cent of the covered blossoms, and 17 per cent of the uncovered had developed. To show the details, in one case 60 blossoms were considered, 9 of which in the covered lot, and 27 in the uncovered, had developed. That is, three times as many flowers had set in the uncovered as in the covered. In another case of 212 blossoms, the fruit numbered 80 and 104. In a case of 123 blossoms, the number of fruit was 20 and 36. * * * *

Our experiments with clovers were tried with both the white and alsike. While the uncovered heads were full of seeds, the covered ones were entirely seedless. This fully explains the common experience of farmers with these plants.

In the symposium referred to at the outset, the first article of the series was from J. C. Gilliland, who, in the summer of 1893, in a large field of medium red clover that came within 30 feet of his door, covered some blossoms with netting, and around others *not* covered he tied a small thread. During the following August he gathered seed from the covered blossom, and also some from the plants not covered; and by carefully counting the seeds he found that the latter gave 21 per cent more seed. His experiments were repeated again, with like results. As the bumble-bees visited the field very profusely this year, it seems pretty evident that the larger amount of seed came as a result of cross-fertilization by the bees. But this only shows what bumble-bees may do. When it comes to the ordinary *honey*-bees, the per cents in favor of uncovered blossoms as against the covered are very much larger. Witness, for instance, the extract from Prof. Cook's article just preceding.

Mr. J. F. McIntyre, a bee-keeper, was a delegate at the California State Fruit-growers' Association for 1893, and reports that:

A gentleman stated that he had a friend in this State who started into fruit-growing several years ago, locating 35 miles from any fruit-growing section, or where any bees were located. The first year that his trees blossomed, and in expectancy of at least some returns from his orchard, what should be the result but complete failure! He was advised to procure some bees to aid in the fertilization of the blossoms, and since then his orchard has been productive.

C. J. Berry, one whose fruit-orchard contains 440 acres, and who is Horticultural Commissioner for Tulare Co., Cal., an inland county that has made great progress in the fruit-industry, gives this valuable testimony:

Bees and fruit go together. I can't raise fruit without bees. Some of the other cranks say I'm a crank; but I notice there is a pretty good following after me, hereabouts, and they keep a-comin'.

Yes, sir, 'e. I have bees all about my big orchard. *Two years in succession I have put netting over some limbs of trees; and, while they blossomed all right, nary fruit; while on the same tree, where limbs were exposed to the aid of bees, plenty of fruit.*

Some three or four years ago, in the State of Michigan, a convention of fruit-growers and bee-men assembled together for the purpose of discussing their common interests; and the fruit-men acknowledged generally that the keeping of bees in the vicinity of their orchards was an important factor in the production of fruit. At the various conventions of the Michigan State Bee-keepers' Association, it has been shown quite conclusively by the bee-keepers who were fruit-growers, that not only more but more perfect fruit is secured by having the orchards in the vicinity of bees.

Again, Chas. A. Green writes for the *Fruit Grower*, published in Rochester, N. Y., an article from which, for lack of space, we shall be able to quote only a couple of paragraphs:

It has now become demonstrated that many kinds of fruits, if not all kinds, are greatly benefited by the bees, and that a large portion of our fruit, such as the apple, pear, and particularly the plum, would be barren were it not for the helpful work of the honey-bee. This discovery is largely owing to Prof. Waite, of the Agricultural Department at Washington. Prof. Waite covered the blossoms of pears, apples, and plums, with netting, excluding the bees, and found that such protected blossoms of many varieties of apple and pear yielded no fruit. In some varieties there was no exception to the rule, and he was convinced that large orchards of Bartlett pears, planted distant from other varieties, would be utterly barren were it not for the work of the bees, and even then they could not be profitably grown unless every third or fourth row in the orchard was planted to Clapp's Favorite, or some other variety that was capable of fertilizing the blossoms of the Bartlett. In other words, he found that the Bartlett pear could no more fertilize its own blossoms than the Crescent strawberry. We have already learned that certain kinds of plums will not fertilize their own blossoms, such as the Wild Goose, etc.

The fruit-growers of the country are greatly indebted to Prof. Waite for the discovery he has made. The lesson is, that fruit-growers must become interested in bees, *and I do not doubt that within a few years it will be a rare thing to find a fruit-grower who does not keep honey-bees*, the prime object being to employ the bees in carrying pollen from one blossom to another from the fields of small fruits as well as for the large fruits.

Mr. F. A. Merritt, of Andrew, Ia., testifies as follows:

THE TWO SIDES OF A TREE.

Our apple-orchard is situated in such a way that it is exposed to both the north and south winds. About four years ago, as the trees on the south row (Transcendenteral, that throws out a heavy growth of foliage at the same time it blooms) began to open its bloom, a heavy south wind prevailed for about five days. I noticed, during this period, that the bees could not touch the bloom on the south side of these trees, but worked merrily on the more sheltered limbs of the north side. What was the result? Those limbs on the north side were well loaded with fruit, while on the south side there was almost none to be seen. Does this prove that these trees depend on the aid of insects to fertilize the bloom? I leave it to the judgment of the reader.

Mr. G. M. Doolittle, in winding up his article for the symposium above referred to, says:

Again, I wish to note, as a matter of history, that, during the past season of 1898, very little buckwheat honey was secured from the buckwheat regions of the State of New York—so little that we have had, for the first time in my remembrance, buckwheat honey selling in our markets for nearly if not quite the same price as No. 1 clover honey, while it usually sells for about two-thirds the price of clover honey. And what has been the result? Why, the unheard-of thing of buckwheat grain bringing 75 cts. a bushel, on account of its scarcity, while the best of white wheat is selling at only 62 cts.! As a general thing, buckwheat brings from one-half to two-thirds the price of wheat. That it now brings nearly one-fourth more than the best of wheat tells very largely, under the circumstances, on the side of the bee.

Mr. H. A. March, of Puget Sound, Wash., one of the most extensive seed-growers of the Pacific coast, testifies that he found the bees very valuable, and that the seed was very much more abundant when the bees were allowed to work on the flowers; and he says that the stone fruits seemed almost incapable of self-fertilization, as he had fully proved by trying to grow peaches under glass.

The editor of the *Rural New-Yorker* put in his paper, unsolicited, this short pithy paragraph:

In those great greenhouses near Boston, where early cucumbers are grown, it is always necessary to have one or two hives of bees inside to fertilize the flowers. No bees, no cucumbers, unless men go around with a brush and dust the pollen from one flower to another.

In the spring of 1892 the late Allen Pringle, of Selby, Ont., one of the leading bee-keepers of Canada, testified that he was summoned to appear before a legislative committee of the House of Assembly of Ontario, to give evidence of the agency of bees in scattering pollen. The Minister of Agriculture summoned not only the leading bee-men, but those engaged in growing fruit, to present the facts, experiences, and the pros and cons on both sides. Not only this, but the scientists were also summoned from Ottawa and Guelph. Mr. Pringle goes on to say, that "the horticulturists, with one single exception, admitted the valuable and indispensable offices performed by the honey-bees in the fertilization of fruit-bloom. And this was corroborated and confirmed by the entomologists. . . . . Prof. James Fletcher, the Dominion Entomologist, said bees did 'not visit in dull weather, and then we have but little fruit in consequence.' . . As to bees injuring fruit, there is no direct evidence." Mr. Pringle also says:

I have kept bees for 30 years, and have grown fruit and clover alongside for 30 years. I have also studied a little and experimented a little in this line as well as many other lines. As to some kinds of fruit—notably apples—I have observed that if, during the bloom, the weather was such that neither the winged insects nor the wind (being wet and cold) could perform their function with the flowers, the fruit was *non est*. When the weather at other times was favorable, and the bloom abundant, I have excluded the bees from certain portions of the tree, only to find the fruit also excluded—but only from those certain portions. . . . . . .

The fruit-growers agreed that the "bees play a very important part in cross-fertilization, and, therefore, should not be destroyed;" that "we are

very generally dependent upon insects for the fertilization of our orchard. To destroy them to any extent would be very injurious to fruit-growers."

The consensus of the meeting was, that "bee-keepers and fruit-growers are of great help to each other, and even indispensable, if each class is to obtain the best results in their work."

Mr. Frank Benton, in the employ of the Department of Agriculture, Washington, D. C., in one of the Government Bulletins for 1894, page 254, commenting on the agency of the bees in the fertilization of fruit-blossoms, says:

The facts they have brought forward are gradually becoming more widely known among fruit-growers and bee-keepers, and additional evidence accumulates. A case illustrating very clearly the value of bees in an orchard has recently come to the notice of the writer, and its authenticity is confirmed by correspondence with the parties named, who are gentlemen of long and extensive experience in fruit-growing, recognized in their locality as being authorities, particularly in regard to cherry culture. The facts are these: For several years the cherry crop of Vaca Valley, in Solano Co., Cal., has not been good, although it was formerly quite sure. The partial or complete failures have been attributed to north winds, chilling rains, and similar climatic conditions; but in the minds of Messrs. Bassford, of Cherry Glen, these causes did not sufficiently account for all the cases of failure.

These gentlemen recollected that formerly, when the cherry crops were good, wild bees were very plentiful in the valley, and hence thought perhaps the lack of fruit since most of the bees had disappeared might be due to imperfect distribution of the pollen of the blossoms. To test the matter they placed, therefore, several hives of bees in their orchard in 1890. The result was striking, for the Bassford orchard bore a good crop of cherries, while other growers in the valley who had no bees found their crops entire or partial failures. This year (1891) Messrs. Bassford had some sixty-five hives of bees in their orchard, and Mr. H. A. Bassford writes to the Entomologist: "Our crop was good this season, and we attribute it to the bees." and he adds further: "Since we have been keeping bees our cherry crop has been much larger than formerly, while those orchards nearest us, five miles from here, where no bees are kept, have produced but light crops."

Again, J. E. Crane writes in this same symposium an article so full of pith and point that I can not forbear publishing the whole of it here in permanent form:

HOW BLOSSOMS ARE FERTILIZED; WHY SOME FLOWERS ARE MORE GAUDY THAN OTHERS; EXPERIMENTS OF CHARLES DARWIN.

Many volumes have been published in several different languages upon the fertilization of flowers—the first by Christian Conrad Springel, in 1798; but the subject attracted but little attention until thirty or forty years later, since which many botanists have given the subject much attention. Our most eminent botanists now classify flowering plants in their relation to fertilization into two classes: *Anemophilous* and *Entomophilous*—literally, wind-lovers and insect-lovers. The flowers fertilized by the wind are dull in color, and nearly destitute of odor or honey. The sexes are frequently separated, either on the same or on separate plants. They produce a superabundance of pollen, light and dry, easily transported by the air or wind.

Pines, firs, and other conifera, are familiar examples, which sometimes fill a forest with "showers of sulphur" when shedding their pollen. Our nut-bearing trees are examples among deciduous trees. The grasses and grains are familiar to all. A kernel of corn will grow as well alone as with other plants; but "the ear will not fill" unless it can receive the wind-wafted pollen from neighboring plants. On the other hand, those plants which seem to have need of bees or other insects to carry their pollen from one flower to another have more showy blossoms, with bright colors, or white, which are showy at dusk, or they give out a strong perfume or nectar, or both. The pollen grains are moist or glutinous, or hairy, or otherwise so constructed as to adhere to the insects that visit them, and thus be carried from flower to flower. In this class of plants or flowers many ingenious arrangements are provided to secure cross-fertilization. One sex is found in one blossom, and the other in another, on the same plant, as in the squash and melon families. In other species the sexes are found upon separate plants, as the willow-trees. In some plants the pistils appear first, and become fertile before the stamens ripen their pollen. In others the stamens shed their vitalizing dust before the stigma of the pistil is ready to receive it.

The common red raspberry matures its pistils first, so that, unless the bees or other insects carry the pollen to it from other earlier blossoms, the fruit is imperfect.

The partridge-berry is very interesting. The blossoms upon about half of the plants produce their stamens first; the other half, the pistil. In a week or ten days the order is reversed in the same flowers.

Many flowers that invite insects appear to be capable of self-fertilization, and often are; but the pollen from a neighboring plant of the same species seems more potent. Some flowers are so constructed that the stamens are placed so that their pollen can not fall upon the stigma of the same flower, but with special adaptation for the transport of pollen by insects from one flower to another. One curious plant produces small inconspicuous flowers early in the season, capable of self-fertilization; later in the season it produces more showy flowers that can become fertile only through the agency of insects.

Many plants remain constantly barren unless they receive the visits of insects. Many of your readers have doubtless observed how the fuschia or begonia never produces seed in a closed room; yet, when set out of doors in summer, they seed abundantly. Still other plants never produce seed because the insects that feed upon their blossoms have not been imported with the plants.

But this is a large subject, and to me one of great interest, as I study the many ways the Author of nature has provided for the best good of all his

works. A large number of examples have been given of bees as agents in the production of fruit and seed, but I will give one or two more.

Mr. H. A. March, of Puget Sound, while here last summer, informed me that he produced large quantities of cauliflower seed, and found bees very valuable, as the seed was much more abundant when bees were provided to work on the flowers.

The stone fruits seem almost incapable of self-fertilization, as is often proven by trying to grow peaches under glass, success seeming to come only when bees are provided when the trees are in bloom. A curious problem has presented itself to the horticulturists of this country for a number of years past, in the refusal of some varieties of the chickasaw plum to produce fruit in the Northern States unless set near some other variety or species of plum, that insects might carry the pollen from one to the other. Such a tree I can see from my window as I write, that is a bank of bloom every spring, but has never, to my knowledge, produced a crop of fruit.

Now, suppose it were true that all trees or plants that produce fruit or seed of value for the use of man would become fertile without the aid of bees or other insects, would it prove them of no value? Not at all. Enough has been written to show that the Creator has desired cross-fertilization among plants, and has wisely provided for it in a multitude of ways; and the chances of such fertilization appear to be as great among plants as among our bees, for which such special arrangement has been made. We might assume it to be valuable or necessary, even if we could see no good reason for it. We all know that birds or domestic animals will prove fruitful for one or perhaps several generations in spite of the intermarriage of near relations; but it is, I believe, the universal experience that such unions are most unwise, and, as a rule, prove injurious.

Some twenty-five or thirty years ago Charles Darwin, in studying this subject, and noting the provisions of nature for the cross-fertilization of flowers, became so much interested in it that he began a large number of experiments to test the value of insects in cross-fertilization, and the effects of cross and self fertilization upon plants. His experiments were conducted with great care, and continued through several years; and his book on the effects of "Cross and Self Fertilization," describing these experiments, containing several hundred pages, is very interesting reading to say the least.

Of some 125 plants experimented with, more than half were, when insects were excluded, either quite sterile or produced less than half as much seed as when insects were allowed to visit them. Among his catalog of these plants I notice the white and red clover. His experiments with these are very similar to those of Prof. Cook, late of Michigan Agricultural College. He says, page 361, of red clover, "One hundred flower-heads on a plant protected by a net did not produce a single seed, while 100 heads on plants growing outside, which were visited by bees, yielded 68 grains of weight of seeds; and as 80 seeds weighed two grains, the hundred heads must have yielded 2720 seeds. His experience with white clover was nearly the same.

Another most interesting result of his experiments was that plants grown from seed from self-fertilized flowers were, as a rule, when grown side by side with seed from cross-fertilized flowers, much less vigorous, although in other respects the conditions were as nearly alike as it was possible to make them. On page 371 he says, "The simple fact of the necessity in many cases of extraneous aid for the transport of the pollen, and the many contrivances for this purpose, render it highly probable that some great benefit is thus gained; and this conclusion has now been firmly established by the superior growth, vigor, and fertility of plants of crossed parentage over those of self-fertilized parentage."

In *Gleanings in Bee Culture* for June 1, 1894, Prof. Cook furnishes the following additional:

Prof. Bailey, the very able horticulturist of Cornell University, writes: "Bees are much more efficient agents of pollenation than wind, in our fruits; *and their absence is always deleterious.*"

The Division of Vegetable Pathology, of the Department of Agriculture, has just issued a most valuable bulletin on "Pollenation of Pear-flowers," by Norman B. Waite. Mr. Waite says: "Incidental mention has been made of insect-visitors. We should not proceed without laying some stress upon the importance of these visits. The common honey-bee is the most regular, important, and abundant visitor, and probably does more good than any other species." He says, further, that cool or rainy weather interferes *seriously* with insect-visits. Many varieties (22 out of 364 of those he experimented with), says Mr. Waite, *require* cross-pollenation; and the pollen must be from a different variety. Bees and other insects are the agents of the transportation of pollen. In summing up, Mr. Waite says—and this from crucial decisive experiments: "Plant mixed orchards, or, at least, avoid planting solid blocks of one variety. *Be sure* that there are sufficient bees in the neighborhood to visit the blossoms properly. When feasible, endeavor to favor insect-visits by selecting sheltered situations, or by planting windbreaks."

Again, E. C. Green, of the Ohio Experiment Station, for June 1st writes:

Quite an interesting fact came under my observation this winter in tomato-forcing, along this line. We had in one house about 200 Dwarf Champions that were planted in August; and by the time winter set in they were as fine and thrifty plants as one could wish to see, and setting their fruit nicely. We felt glad to think what a nice crop of tomatoes we should have; but when January came, and they began to ripen up their fruit, the bulk of it was about the size of hickorynuts, and *without any seeds.*

The tomato, as you know, is a bisexual flowering plant, but in this case it is evident that the pollen from the same flower was what is called "self-irritant." If bees or some other cause had carried the pollen from one flower to another, or one plant to the other, there would have been a good crop. I have been doing something in cross-fertilizing tomatoes this winter, and have been surprised at the ease with which they crossed, having used the Potato-leaf, Dwarf Champion, Ponderosa, Peach, and several of the common kinds, making in all about 40 crosses. I do not think I shall fail to get seed except in a few of them. I expect that, from the seed, I shall get a lot of "mongrels," as one writer in GLEANINGS calls such crosses; but I prefer to call them crossbreeds, as "hybrid" has a different meaning.

Still again, Prof. V. H. Lowe, of the Geneva Experiment Station, New York, in 1899, covered a certain set of small pear-trees, as it was not practicable to use large ones in a hood of sheeting. This hood was large enough to sit down over the whole tree, something in the form of a bag, and the lower end of it was tied around the trunk of the tree. The object of this was to keep out insects, ants, bees, and any thing, in fact, that might assist in pollenizing the blossoms. On all of these trees so covered, there was a large number of buds, and all the conditions were favorable for a good crop, except that the flight of insects was entirely cut off. Now, then, for the results: Out of the whole lot of trees covered, there was just one fruit. On another set of trees of the same sort and size not covered, there were 145. In the other case, where it was not practicable to envelop the whole tree, one large limb, for instance, would be enclosed in the bag, the mouth of the bag being tied around the trunk of the limb. In one such instance there were 2483 buds on an apple-tree that were thus covered with the sheeting. Out of that number just one fruit matured. There was plenty of fruit on other portions of the tree where the limbs were not covered. In one case, where the sheeting broke open so that insects could get in, there were 13 perfect fruits from 818 buds. It was clearly shown that bees or other insects play a most important part in the pollination of average fruit-trees.

COGGSHALL'S LOS MANGOS APIARY, CUBA.

G.

GILL-OVER-THE-GROUND. (*Nepeta Glechoma.*) This plant yields some honey; and in some localities favorable to its growth, such as the beds of streams where there is plenty of rich vegetable mold, it has furnished so much honey that it has been extracted in considerable quantities.

The honey is rather dark, and believe a little strong; but if it is allowed to become perfectly ripened, I think it will pass very well. Perhaps the greatest benefit to be derived from it, however, will be to keep the bees uninterruptedly rearing brood, until clover and locust begin to furnish a supply.

This plant is a near relative of the catnip, which it closely resembles in the shape of the leaf. Both were originally from Nepeta, in Germany, hence the Latin names, *Nepeta Cataria* and *Nepeta Glechoma.* I presume it would be an easy matter to raise this plant from the seed, but I would hesitate some in sending out such seed, because it is such a noxious weed. Indeed, it is quite impossible to exterminate it.

GLUCOSE. See HONEY ADULTERATION.

GRANULATED HONEY. See CANDIED HONEY.

GOLDENROD. (*Solidago*). This, in some localities, furnishes the bulk of the great yield of fall honey. It grows almost all over the U. S., and there are so many different varieties that it would be almost out of the question to try to give you a picture of it at all; the botany describes 53 different varieties, and it is common to find a half-dozen growing within a few rods. Its name describes it, so that almost any one should be able to identify it. If you see autumn flowers, as yellow as gold, growing on the top of tall rods, you may be pretty sure they belong to this family. The flowers are very small, but grow in great masses, sometimes in long racemes, and again in dense bunches. The general characteristics are such that, after a little practice, you can readily identify any one of the family; but to assist you, we give the cut below.

Bees are almost incessantly humming over the flowers in some localities; in others, they seem to pass them entirely unnoticed. I have passed it in localities where bee-keepers say they have never seen a bee on

THREE SPECIES OF GOLDENROD.

good home for the bees; 2. It must in addition be so constructed as to be convenient it at all. Bees are seen on it, occasionally, in our locality, but I do not think they get enough honey from it, in ordinary seasons, to make it perceptible in the hive.

The honey is usually very thick, and of a rich golden color, much like the blossoms. When first gathered, it has, like the honey of most other fall flowers, a rather rank weedy smell and taste; but after it has thoroughly ripened, it is rich and pleasant. On getting the first taste of goldenrod honey, one might think he would never like any other; but like many other kinds, one soon tires of the peculiar aromatic flavor, and goes back to the clover honey as the great universal staple to be used with bread and butter. A patch of goldenrod might have a place on our honey-farm, and perhaps, with cultivation, it might do better and give a surer crop in all localities; but as it is only a common weed on our farms, I would hardly favor a general distribution of the seed.

GUAJILLA. This is a very important honey-plant, or tree, rather, in Texas in the dry arid portions where there is little or no irrigation, and where nothing, in fact, grows except mesquite, catclaw, sage-brush, and other desert plants. The fact that it does not depend on irrigation, and needs only a scanty amount of rain early in the season, makes it most valuable to the bee-keeper in those regions where it grows and yields large quantities of beautiful water-white honey. Indeed, it is the finest produced in Texas, and is so near water-white that it is nearly as clear as pure water. It is at its very best in the region of Uvalde, Texas.

The leaves look like a small delicate fern, and partake somewhat of the nature of the sensitive plant, for when touched they will immediately close. The view below shows the leaf photographed life size.

GUAJILLA LEAF (LIFE SIZE,)

H.

HAULING BEES. See MOVING BEES.

HEARTSEASE (*Polygonum persicaria*). This is one of a large family of honey-bearing plants of which the common buckwheat is one. Heartsease, sometimes known as knotweed or heartweed, and (perhaps incorrectly) smartweed, is scattered over certain portions of the West, particularly in Illinois, Kansas, and Nebraska. In the last named it reaches a height of from three to five feet, and grows luxuriantly on all waste and stubble lands. The flowers in clusters are generally purple, and, in rare instances, white. It yields in Nebraska, and other States in that section of the country, immense quantities of honey. One bee-keeper, Mr. T. R. Delong, at the North American convention held in Lincoln, in October, 1896, reported that two of his colonies yielded each 450 lbs. of extracted, and that the average for his entire apiary was 250 lbs. per colony—all heartsease. While perhaps these yields were exceptionally large, quite a number of other bee-keepers reported at the same convention an average of 200 lbs. from the same source. When I visited Nebraska last there were acres and acres of this honey-plant over the plains as far as the eye could reach; and as it yields honey from August till frost, one is not surprised at the enormous yields.

The extracted honey varies in color from a light to a dark amber; and the flavor, while not quite up to the white honey, is very good. Heartease comb honey, in point of color, is almost as white as the clover.

The extracted granulates in very fine crystals, and looks very much like the candied product of any white honey. Care should be taken in liquefying, as heartsease honey is injured more easily, and to a greater extent, by overheating, than any other honey.

HIVE-MAKING. Unless one is so situated that freights are high, and unless, also, he is a mechanic, or a natural genius in "making things," he had better let hive-making alone.[443] Hives can be bought, usually, with freight added, for a great deal less than the average bee-keeper can make them himself, if we consider spoiled lumber, sawed fingers, and the expense of buzz-saws; and, besides, hives made in the large factories, where they are turned out by the thousands, by special machinery run by skilled workmen, are much more accurately cut, as a general thing. But there is lots of fun in making things, even if they are not so well made; and there are some rainy or wintry days in the year, when, if one is a farmer, for instance, he can as well as not, and at little or no expense for time, make a few hives and other "fixin's." Again, if one lives in a foreign country he may not be able to get the hives that I shall recommend.

REQUISITES OF A GOOD HIVE.

While it is very important to have good, well-made hives for the bees, I would by no means encourage the idea that the hive is going to insure the crop of honey. I think, as Mr. Gallup used to say, that a good swarm of bees would store almost as much honey in a half-barrel or nail-keg as in the most elaborate and expensive hive made, other things being equal. This is supposing we had a good colony, in the height of the honey-season. If the colony were small, it would do much better if put into a hive so small that the bees could nearly or quite fill it, thus economizing the animal heat, that they might keep up the temperature for brood-rearing, and the working of wax. Also, should the bees get their nail-keg full of honey, unless more room were given them at just the right moment a considerable loss of honey would be the result. The thin walls of the nail-keg would hardly be the best economy for a wintering hive, nor for a summer hive either, unless it were well shaded from the direct rays of the sun.

P. H. Elwood, of Starkville, N. Y., who owns over 1300 colonies, said in *Gleanings in Bee Culture*, April 15, 1891, "A good hive must fill two requirements reasonably well to be worthy of that name. 1. It must be a

to perform the various operations required by modern bee-keeping. The first of these requirements is filled very well by a good box or straw hive. Bees will store as much honey in these hives as in any, and in the North they will winter and spring as well in a straw hive as in any other. They do not, however, fill the second requirement; and to meet this, the movable-frame hive was invented."

Under the subject of HIVES, a little further on, will be shown styles and the special features that belong to each. But there is only one hive that is used largely throughout the United States, and that is the Langstroth—that is, it embodies the Langstroth dimensions. We start first with the frame, 17⅝ long by 9⅛ deep. This establishes the length and depth of the hive. As to width, that depends upon the number of frames used. Some bee-keepers prefer eight, perhaps the majority of them; others ten, and still others twelve frames. Where one runs for extracted honey the ten-frame width should have the preference, especially in the South. If one produces only comb honey the eight-frame-hive width should be the one selected, particularly in the North, where the honey-flow is of short duration and is principally from clover and basswood. The selection of the frame, and the number to the hive, then, determines the dimensions of the hive itself.

I said the Langstroth is the standard throughout the United States; but of late there has been a tendency toward a frame of the same length, but two inches deeper. There is also a tendency to go to the other extreme in adopting a frame of Langstroth length, but two or three inches shallower, using two stories of such a hive for a single brood-nest.

On account of the diverse notions of bee-keepers, and the peculiarities of locality, it would hardly be worth while to give general directions for the manufacture of any one hive; and, besides, no printed directions will give as good an idea of the construction of a hive as the very thing itself. For these and other reasons it would be far better for the one who intends to make hives to send to some manufacturer for a sample in the flat, all complete. With the several pieces for patterns he will then know exactly the shape and dimensions, how to make the rabbets, and in general how the hive is constructed in every detail. If one does not find on the market just such a hive as suits his notion, of course he sees, or thinks he sees, "in his mind's eye" just what he wants to make; but in that case I would advise him to make a sample or two before he makes very many of them; for nine times out of ten—yes, ninety-nine times out of one hundred—he will discard the one of his "own get-up," and adopt some standard made by manufacturers generally. In the directions that I shall give in this work I shall not, therefore, attempt to give any dimensions, for I assume that my A B C scholar in hive-making will know just what these are to be, and will govern himself accordingly; but I would strongly urge him to select some standard hive as his working model; for no beginner will be able to improve very much on the work of those who have spent years in the study of bees and hive-construction. It ought hardly to be necessary to say this, but the records show that there are a lot of bee-hive inventors who hardly understand the first principles of hive-construction.

LUMBER FOR HIVES.

Get white pine.* If you can not get it, you would better use whitewood. If you can not get that either, get the best lumber that is kept for house-building, in your locality. You can get barn boards that will answer the purpose for about $30 per 1000 feet. As soon as you get your lumber home, have it nicely "sticked up." I say nicely, for I do not believe I ever had a boy that would put up lumber safely, unless he was told a great many times. Now, before you stick it up, you are to prepare a level place for the first board; or, rather, you are to have the first board lie straight and flat. If it is to be left out of doors, it should have slant enough to carry off the water. If you have shop room, you can put it indoors. Do not lay the first board on the floor, but have some sticks under it. These sticks for sticking up lumber should be of an exact thickness, and I think it will pay to provide some that are just right. If you are making many hives, you will have refuse sticks that will come very handy for this purpose. The sticks should be about 1⅝ inches wide, exactly ⅞ thick, and 15 or 20 inches long. A stick should be placed at each end of the boards, and two more between them, so as to make the spaces about equal. Put the sticks exactly over each other, or you will, if you have a large pile, have the boards bent or warped by the weight of those above. When they are all piled up square and true, you can feel safe in regard to them.

* In some parts of California and Arizona redwood is preferred.

If you are going to make accurate work, you must have your lumber all of an exact thickness; and as it is much easier to talk and write about having it exactly ⅜ than it is to make it so, I will explain to you a kind of gauge that I had to give the planing-mill men, before we planed our own lumber. Below is a picture of it, full size.

GAUGE FOR PLANING LUMBER.

When you carry them the lumber, tell them if it is planed so that the "too large" notch just fits it, it will have to be planed over again; and that, if it goes into the "too small" notch, it is spoiled. This will soon get them into the habit of having it "just right," every time. Their planers must also be so adjusted that both edges of the board are *just right*. If the lumber is not well seasoned it may be well to have it planed to the too-large gauge; but this is a very bad

BARNES SAW.

way of doing, on many accounts. Get your lumber seasoned as well as it possibly can be, before you commence work, and, if you are *obliged* to use that which is not well seasoned, cut your stuff to the exact length, then stick it up, and leave it until the very last moment, before you take it to the exact width you wish it. This is, perhaps, one of the surest ways, especially when the work is not all to be sent off immediately. We frequently leave covers in this way, and only bring them to the finishing width the very day they are to be shipped. It is especially needful that the covers be well seasoned, for a season-check would let in water, and endanger the life of the colony.

A great many Barnes foot-power saws are in use; therefore I shall give my directions for them. They can be obtained of W. F. & J. Barnes, Rockford, Ill. The price without the scroll-saw is $35.00. These, for foot-power saws, do very well for light work; but when you wish to do heavy sawing or ripping, you will have to use the crank arrangement, shown on the side; and, of course, you will then require an assistant.

A HOME-MADE HAND-POWER BUZZ-SAW.

The accompanying cut needs almost no description. The saw-arbor is geared to a crank about the same as may be done on the Barnes machine. Of course, there is no foot-power attachment to it; but if you have a hired man who has nothing else to do on a rainy day, you can set him to turning the crank while you do the ripping or cross cutting, as the case may be. This home made machine is very effective, and will do very good work, as we know by experience with machines of that class. Even though two men, with a couple of good sharp carpenter saws, might do nearly as much work in cutting and ripping, they could not possibly do as accurate work. With the above machine, rigged with the gauges described, a couple of boys would do the amount of work that men would, and it would be more accurate than an expensive carpenter with try-square and smooth-plane could possibly make it. I have

no doubt but that the boys would cut up double the firewood they could with the ordinary hand-saw.

HOW TO SAW UP THE BOARDS FOR THE HIVES.

We will first talk about making the body of the hive. Your pile of boards is to be cut up in lengths depending upon the style and size of hive you are to make. If you have quite a pile of stuff, a gauge that you can push the boards against will be very handy. Always commence at the best end of the boards. If the end is checked or bad, allow a little for waste. Cut off a few lengths, and leave the surplus of half a foot or more on the last piece; that is, do not cut it off. Pile these last pieces by themselves. You will need an assistant to do this; and if you have a boy ten or fifteen years old, he can help "papa" a "big lot" in making hives.

As we desire to make the machine rip boards to the desired width, we will set the gauge to the proper place. After your boards are all cut up, you will proceed to bring them to an *exact* width and straighten one side. As we want the boards to finish a certain width, we will trim them, the first time, a little; those that will not hold out this width can be saved to make frames of. To bring one side straight, you must set the parallel bar at the left of the saw, at just the right distance from it, and then push the boards through, holding closely up to the gauge. Very likely when you start, your saw may "run," as it is termed; this may result from either of two causes. If the teeth are filed longer on one side than on the other, and insufficiently set, the saw will be very likely to run either into or out of the lumber. This will not do at all, for we can never have an accurate hive unless we get a straight edge, in the first place, to work from. Give the saw set enough to make it run clear, as explained further on, and have the teeth so that the cut ahead of the saw shows as in the diagram below.

IMPROPERLY FILED. PROPERLY FILED.

A second cause of trouble may sometimes be found in your parallel bar, which must be just parallel, or you can not have a true straight cut. The diagram will show you the consequences of having this bar improperly set.

In Fig. 1 the bar is set so that the board between the saw and the gauge wedges, as it were; and, when this is the trouble, you will see the surface, at A, shows as if it had been planed; this is done by the face of the saw, which rubs or burnishes the wood, as it squeezes past. The remedy is plain; move the end, D, away from the saw a little, or the other end nearer to it, as may be nec-

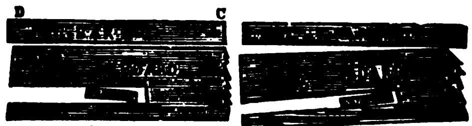


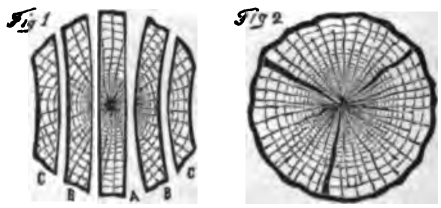
Fig 1 Fig 2

SETTING THE PARALLEL BAR.

essary to preserve the proper distance. In Fig. 2 we see the opposite extreme; and when this is the trouble, you will find it almost impossible to keep your board up against the gauge, for the saw is all the time crowding it off. The piece B will constantly be getting too narrow, and the strip that comes off, too wide. Before you attempt to do any work, and thus spoil your lumber, you should test your saw and gauges on some refuse pieces. When it is all right, the saw should run clear and smoothly in the center of the saw-cut, and the stuff should easily be kept close up to the gauge.

While you have been doing this work, the movable cross-cut gauge to the table should be taken off, as it would only be in the way. After one edge is trimmed, set your gauge so as to cut to the desired width, and bring the boards all to this width.

Now, before going further you are to sort the boards, so as to have the heart side of the lumber come on the outside of the hive. If you look at the end of each board, you can see, by the circles of growth, which is the heart side, as is shown in the cuts.



WHY BOARDS WARP.

At B, you see a board cut off just at one side of the heart of the tree; at C, near the bark; at A, the heart is in the center of the board. You all know, almost without being told, that boards always warp like C; that is, the heart side becomes convex. The reason is connected with the shrinkage of boards in seasoning. When a log lies until it is perfectly seasoned, it often checks, as

in Fig. 2. You will observe that the wood shortens in the direction of the circles, and but very little, if any, along the lines that run from the bark to the center. To allow this shrinkage in one direction, the log splits or checks in the direction shown. Now, to go back to our boards, you will see that B shrinks more than A, because A has the heart of the tree in its center; that C will shrink, in seasoning, much more on the bark side than on the heart side; that this can not fail to bring the board out of a level; and that the heart side will always be convex. You have all seen bee-hives, probably, with the corners separated and gaping open, while the middle of the boards was tight up in place. The reason was, that the mechanic had put the boards on wrong side out.* If the heart side had been outward, the corners of the hive would have curled inwardly; and if the middle had been nailed securely, the whole hive would have been likely to have had close, tight joints, even if exposed to sun, wind, and rain. This matter is especially important in making covers to hives. If your boards are all sorted with the heart side downward, we are ready to proceed. I say heart side downward, for you want them placed just as they are to be used on the saw. I have seen boys who would turn every board over, just as they picked it up to put on the saw-table, instead of piling the whole just as they were to be used. I have seen others who would carry each one of several hundred boards 6 or 8 ft. to the saw, when the whole pile might have been put almost within one foot of the place where it was to be used. It is very awkward and extravagant to do work in this way.

In cutting small pieces where we work near the saw, we always use what we call "push-sticks." These are simply curved sticks about 8 or 10 inches long, one end of which is shaped something like the handle of a pistol, and the other end is notched in such a way as to make a shoulder crowding against the stuff that goes against the saw. If the work slips from the saw, or any thing happens, all the harm done is, that the push-stick has been "chawed" into by the saw, and not your hand. And I might remark here in passing, that it is always better to use the push-stick where you can. Of course, where you are sawing up boards, and your hand is four or five inches away from the saw, the push-stick is unnecessary.

*If the hives have the dovetailed, or, as it is sometimes called, the lock-joint corner, this gaping is impossible.

We have thus far been using the rip-saw in edging up stuff. Our next business is to cut boards across the grain, and we therefore change our rip-saw to a cross-cut.

I think we would better "oil up" at about this stage of proceeding. I do not know why it is, but I scarcely ever take hold of a foot-power saw when it would not be greatly improved by giving it a thorough oiling. It is really a saving of time, as well as of strength, to oil your machinery often. Much time is also saved, in changing saws, by having your saws and wrench close at hand. A ten-cent monkey-wrench is sold which is just right for Barnes saw-mandrel, and we used to keep one tied, by a stout cord, to the frame of the machine, that it might be always in readiness. To be obliged to stop your work, and hunt for tools when you are in a hurry, is "awful." You would better fix some kind of a drawer in your saw-table, to keep your saws, or they may get down among the rubbish, and be lost. I *have* known people to lose their cut-off saw, and be obliged to stop and hunt for it; and I should not be surprised if they scolded somebody who was not to blame at all. I have spoken of having one of the children help by handing you the boards, etc.; if they do, be sure that you make the work pleasant for them. If you lose your tools, and scold, you certainly will not make good hives.

You probably have not made any mistakes thus far; but now, before you commence cutting off the pieces to the exact size, be careful.

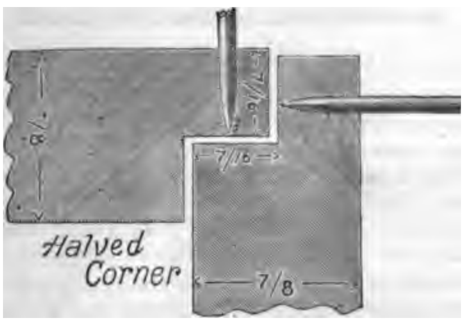
To provide against mistakes I would have a gauge like that shown in the accompanying cut; and it is the same thing that is used

GAUGE FOR FRAME-MAKING.

further on in frame-making, where it will be described a little more minutely. One of the brass stops should be set at such a point that it just measures the length of one of the sides of the hives, so that, when the board has been cut off on your foot-power buzz-saw, it will just slip between the two points. On the reverse side of the gauge, the brass stop should be so set that it will just take in one of the end-pieces of the hive. I think it will be well to have two sets of gauges—one for frame-making and one for hive-making; because experience has shown that it is not wise to depend too much on measuring with rules and squares, for the eye can not measure exactly when

the stuff is the right length, according to the graduations on the square. Such measured stuff may vary all the way from plump to scant measure, and this is something that we can not tolerate in making hives. If you attempt to measure with a square, you will get it wrong side up or something, and get your gauges set wrong. It was not long since that one of the men cut up a whole pile of boards to the wrong length, because he looked on the wrong side of the square. For fear he would do something of the kind, he was given a board just right, for a sample; but some one else wanted it, and so he took the dimensions, and it turned out as I have said.

The length of the side and end pieces will depend upon what method you adopt for nailing the hives together at the corners. If you "halve" the corners, either the ends or the sides should be $\frac{7}{8}$ shorter than the outside width or the length of the hive, as the case may be. If you miter the corners, cut both sides and ends to the exact length of the side and end of the hive. If you use what is called the box-lap corner—that is, one straight piece nailed on to the end of another, either the side or end pieces should be $1\frac{3}{4}$ inches shorter than the length or width of the hive, as the case may be. But the box-lap joint does not permit of cross-nailing; and if you propose using the miter corners, you will have to have iron gauge-frames, or something to hold the pieces up together while nailing; otherwise it will be very difficult to nail the hive together; and I would therefore advise you to use what is called the halved corner. What is meant by this, is illustrated in the accompanying cross-section. Out of both sides and ends,



a rabbet, $\frac{7}{16}$ deep and $\frac{7}{16}$ wide, is cut. As either the sides or ends will have to be cut $\frac{7}{8}$ inch shorter than the length or width of the hive, I would recommend that it be taken out of the end-pieces.

Now, then, before you begin cutting off any considerable number of pieces, you must look sharp to your gauges, and determine whether your buzz-saw runs true. When you get nicely to going, try your gauge occasionally to see whether your stuff does not vary.

While you are cutting up the boards you will find that you will occasionally run into knots. It is desirable to avoid these as far as possible; and this you can do by reversing the end of the board; and this will make the knot come in the center of one of the side-pieces. We want to manage so as not to be obliged to work the knots.

HOW TO HALVE OUT THE BOARDS.

On the under side of the Barnes saw-table you will find a lever by which you can raise or lower the table. Raise the table up until the saw will cut just $\frac{7}{16}$ deep. Next set your ripping-gauge so that it will be just $\frac{7}{16}$ from the saw. Take one of your boards and pass the end of it over the saw. The edge of the cut should be now just $\frac{7}{16}$ in. from the end of the board, and just exactly $\frac{7}{16}$ deep. Be sure you make no mistake here. Then go ahead and make saw-cuts on each end of the side and end boards. You should now take off your cross-cut and put on your rip saw. Leave the ripping-gauge on, as it will be just right, probably. Now turn the board on end and pass it over the top of the saw so as to meet the other saw-cut. If you have made no mistakes, and have done every thing right, you will have a rabbet cut just $\frac{7}{16}$ deep and $\frac{7}{16}$ wide across the grain. To make sure you are right, measure. As a further precaution, rabbet out a pair of sides and a pair of ends; and now put them together to see whether your hive measures right. If so, you are safe in going ahead in cutting out the rabbets.

CUTTING OUT HAND-HOLES.

The body of our hive is nearly all done, except the handles, or, rather, hand-holes, that you lift them by; these are made with a wabbling saw. Sometimes our saws have a fashion of "wabbling," just when we would rather they wouldn't, and it would seem to be quite an easy matter to make one wabble: so it is. The way in which we make a saw wabble, ordinarily, is by a pair of wooden washers like this cut. The saw should be securely clamped between the two wooden washers; that is, clamped so it can not really slip round, or out of true. I mean by out of true, so that the teeth are just as long on one side as on the other. Unless you have it so, the cavity will be deeper at one side than

at the other. You will also need both the parallel and cross-cut gauge for this business, and they are to be so set that, when the boards of the hive are carefully and slowly dropped down on the saw, one end at a time, a nice cavity for the fingers will be cut. To smooth out the bottom of the cut, you have only to move your board slightly sidewise just before you lift it off the saw. This trims off the strings, as it were, left between the saw-teeth. I would have these handles made in the sides, as well as the ends, for it is often convenient to lift a hive when the ends, one or both, are not convenient to get at; for you must remember that our hives can be placed tight up against each other, as there is nothing in the way of so doing. Of course, hand-holes should be cut in the supers or half-depth bodies. They are not heavy, like full bodies, it is true, but we need something to lift them by. I omitted to say before, that the hand-holes should be $\frac{5}{8}$ inch deep and $\frac{7}{8}$ wide. If you make them narrower and shallower, it will not be as easy to lift the hives, for sometimes a body may weigh a hundred pounds, and you need all the grip you can have. Some prefer cleats nailed all around the hives. While they are a little handier to get hold of, they are in the way, and add to the expense, as well as interfere in closely packing the hives together for moving.[447]

BEVELED OR SQUARE EDGES FOR HIVES.

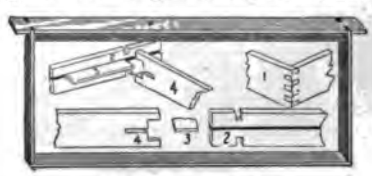
You will observe that thus far the directions imply hives with square edges. In a former edition of this work we recommended what was called the Simplicity hive. This had what are called beveled edges—that is, the opposing surfaces of the hive that came in contact were beveled at an angle of 45°, so as to shed water; but as bees will propolize the two sections of a hive together, it is often difficult to separate them by reason of the propolis. For that reason there seems to be a universal agreement among all practical bee-keepers that the edges of the hive should be square, so that, when they are gummed together, as the bees will surely do, they can be readily pried apart with a screwdriver, or with the blade of a large knife. Aside from this, it is easier to make the square edges. It requires less mechanical skill to make all parts come together true. Theoretically, the water would seep into these cracks and rot the edges of the hives. But such has not been found to be the case in practice. Besides that, the bees gum the cracks together so that neither water nor cold air can enter. Therefore these plain square edges are just as warm as those that have the telescope principle. Another thing, by sliding the cover or edges of the body above, the bees can, to a very great extent, be brushed off, and so prevent maiming and killing bees. Any form of telescope cover is quite liable to mash a lot of bees unless a smoker and brush are used pretty vigorously to brush off each bee; and it is not many apiarists who will take all this precaution. They will claim that their time is more valuable than the few bees killed each day.

FRAMES FOR HIVES.

It is a very important thing to have all our frames, as well as our hives, exact in size; and to insure this, we have gauges made for each separate part. We formerly used wooden gauges; but after long use, we find there is danger of inaccuracy from the shrinking and swelling by changes of weather, or loosening of joints by use, and we have, therefore, decided on steel gauges, which we make of a cheap carpenters' square, such as are to be had at almost any hardware store. The stops are made of brass, and are put on with rivets, as there is always more danger of a solder joint giving way than of a riveted one. The drawing below will make it all plain, I think.

GAUGE FOR FRAME-MAKING.

The plate on the end is put on that end of the square that reads one inch, thus enabling us to read the dimensions in inches, at the same time that we are trying a piece of board to see if the length is right. One side of the square gauges the top-bar, and the other side the bottom-bar. The notch in the side gives the length of the end-bars.



A CHEAP FRAME.

If you wish to make a cheap frame, and do not care any thing about the sagging of the top-bars and the building of burr-combs in between the upper and lower set of frames, or between the brood frames and sections, you can not get up any thing cheaper than the one shown in illustration above.

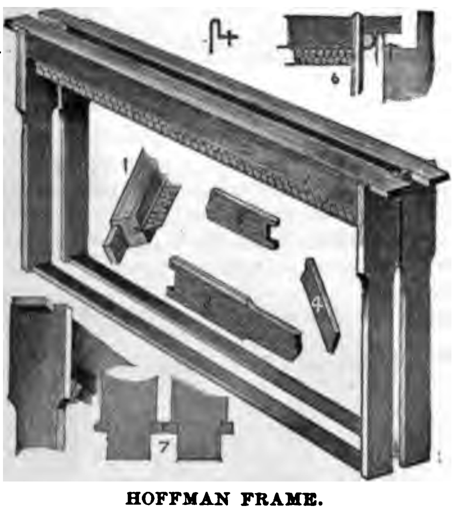
A frame of this description can be driven together, and will hold tolerably well without nails; but, of course, to make it secure it should be nailed.

THICK-TOP-BAR FRAMES.

On account of the aforesaid inconvenience of the sagging of top-bars, and the unnecessary building of burr-combs between the upper and lower set of frames when extracting, in 1889 and '90 an effort was made to get rid of these undesirable features; and the discussions in *Gleanings in Bee Culture* which followed since then show quite conclusively that a top-bar 1⅛ inches wide, and ⅝ or ⅞ thick, having a bee-space in the hive to allow ¼ inch, and also having the separate frames spaced from each other 1⅜ from center to center, will be nearly proof against the building of burr and brace combs.[451] The L. frame is what is called a "long" one; that is, the top-bar is rather longer than the other sizes of frames; and to prevent its sagging, and thus preserve the proper bee-space, experience has shown that it can not be much less than ⅝ of an inch thick.

SELF-SPACING FRAMES.

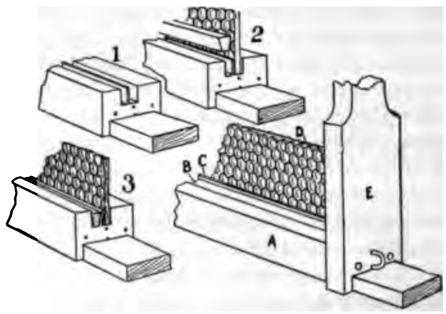
A few years ago the loose unspaced frame or the old-style Langstroth was the only one



HOFFMAN FRAME.

that was used to any considerable extent; but in later years bee-keepers have discovered that the self-spacing type of frame is superior for many reasons, chief among which may be named the following: First, labor is very greatly economized. The frames can be handled in groups of three or four; and, when set down in the hive, can be shoved up together at one operation without the necessity of fingering over each frame to get it spaced exactly the right distance from the others. Second, beginners and careless bee-keepers of extended experience do not make bungling work in spacing. There is no guessing or haphazard spacing; and the consequence is, the combs are even in surface and uniform in thickness. Third, the spacing feature of the frames, of whatever sort they may be, holds the frames securely in position, and at equal distances apart. This is of great importance in the moving of bees.

The end-bars, left wide at the top, and touching about 2¼ inches, form the self-spacing feature of the frames. One side of the end-bar is brought to a blunt V edge, and the other is made square. The two edges come together as shown at 7, in the cut; and the object of this angular contact is to reduce propolis-sticking, and also to a great extent bee-killing, even when the frames are carelessly handled.



The Hoffmans are supplied with thick and wide top-bars of a kind that practically does away with the burr-comb nuisance,* thus rendering it possible to lift off upper stories from the brood-chamber without tearing loose any burr-combs more or less filled with honey. The under side of the bar has a double groove, in one of which is inserted the foundation, or "starter," and the other a wedge-shaped strip of wood which, when driven down, forces the center partition formed by the double groove hard against the foundation, securing it fast.

An important improvement, which we introduced in 1897, and which met with ready favor, was reducing the length of the projection by which the frame is supported. This leaves a bee-space around the end, as shown at 6 in the cut. A staple under the projection, and abutting against the metal rabbet just opposite, prevents end-play and propolis-sticking. In removing a single

*If the bees are overcrowded for room they will sometimes build a few even with such frames.

frame with the long top-bars it was sometimes necessary to break this gluing of the ends of several frames before the one sought could be removed.

THICK-TOP STAPLE-SPACED FRAMES.

There is a class who, while they regard with much favor self-spacing in frames, object to the Hoffman, either because they have not learned how to use it or because in their locality propolis is deposited so freely as to render handling of this particular style not as pleasant or perhaps as rapid as some frame having a metallic spacer with less edge of contact. For bee-keepers of this class we know of nothing as good or as cheap as our regular thick-top frame we have sold for years, with staples driven as

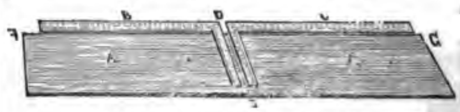
shown in the illustration. One is driven under the projection of the top-bar at each end, one on each diagonally opposite side, making four in all for each frame. They may be used in the end-bars lower down, but we do not regard them as necessary.[455]

These frames may be handled in every way as the Hoffman, save in the one point that they can not be picked up in pairs or groups as can the Hoffman.[459] But to offset this they may be separated—that is, pried apart from each other—easier, and this in some localities, and with some bee-keepers, is quite important.[463]

This frame with staple spacers is no experiment, for we find it has been used for years, and quite largely, in parts of York State where propolis is a little too plentiful for the Hoffman. If there are some who prefer a plain unspaced frame, the side staples may be left off entirely; but it will be necessary to use the staples under the top-bar projections.

CONCLUDING REMARKS ABOUT HIVES.

Work carefully, and avoid mistakes and blunders by carefully measuring, trying, and testing every thing as you go along. Do not get a lot of hives nailed up, and then discover that the frames will not go in them properly, but have a frame right at hand, and, before you drive a nail, put the frame in place and see if it is right. More than this, be sure that your *frame* is just right. Many bad blunders have resulted from picking up a frame *supposed* to be right, but which was found to be a little too large or too small, in some of its dimensions, after a lot of hives were made to match it. Have a good steel square, and keep it carefully, that it may not get out of true, or get rusty or injured in any way. To test its exactness, lay it on a broad straight-edged board, and draw a fine line along the blade of the square, with a keen-pointed knife; then reverse it, and see if the knife-point runs in the same track. The drawing below will show you how.



HOW TO TEST A SQUARE.

Let A A represent the board with the straight edge. Do not say, "This edge is straight enough," until you have made it as exact as you can. Lay the square on as at B, and draw the line, D E, with your knife-point; now turn it over as at C, and draw a line in the same place, or so near it that you can readily see if the two are exactly parallel. You can take your board to the hardware store, and pick out a square that is right, or you can get the one that is nearest right, and then make it right by filing. Another point: you will find squares with the marks on one side not exactly agreeing with those on the opposite side. This is a very bad fault indeed. Our blacksmith and foreman once had quite a dispute on some iron gauge-frames, and, when the matter was investigated, it was found the square given the blacksmith varied a 32d of an inch in the way I have mentioned. Further investigation showed we had but one square on the premises that exactly agreed on both sides. Now, when you go to buy a square, *look out*.

When you get a square that you know you can "put your trust in," go ahead, but work carefully. Say over and over to yourself, when starting out, "Suppose I should find,

after I get these done, that they are all wrong;" and so measure and try your work, at every step. It is just as easy to cut boards in the right place as it is to cut them in the wrong one; and it is just as easy to have all the different parts of your work nice and accurate as it is to waste your time by careless bungling, and then trying to patch up the consequences of your own awkwardness. I know, for I have made a great many awkward mistakes in my life, and I also know, by experience, that one so awkward and careless that he, at times, almost feels as if there were no use in trying to be a mechanic, or hardly any thing else, for that matter, *can* learn to be careful and to do nice work. I also know the thrill of pleasure that rewards one after he has successfully fought these besetting sins, and come out triumphant. Once more, be careful; work slowly, until you know your work is all right; have your tools all nice and sharp; keep every thing piled up in neat order; look pleasant, *be* pleasant, and thank God every day for being a great deal kinder to you than you deserve, while you ask him to help you overcome these besetting sins.

PUTTING CIRCULAR SAWS IN ORDER.

And now I am going to take a little space to talk to you about putting circular saws in order. It is no use to say you can not sharpen a saw, for you *must* do it, or you are not fit to be a bee-keeper. Perhaps I can help you a little.

We will take the cutter-head for an illustration, for it embodies nearly all the principles involved.

CUTTER-HEAD FOR GROOVING SECTION BOXES.

The point, or spur, D, is, of course, to cut a little ahead of the chisel-shaped cutter, C, and is to gauge the exact width of the groove, while C follows after, and takes out a shaving of wood. Now, suppose the tool be so carelessly ground that the heel, B, is higher, or, rather, further from the hole in the center than the cutting edge C; it is very plain that the heel would only rub on the wood, get hot, and make things smoke, without doing any cutting at all. At about this stage, the operator of the foot-power saw is in danger of losing his temper—especially if he has tired himself out, and worked himself into a perspiration, without stopping to examine into the matter. To illustrate, I will give a letter that Barnes Bros. wrote us after one of our customers had complained of his cutter-head.

> We mail you this day the cutter-head that Mr. ——— returns by our request, for our examination. He has ground it, or sharpened it, from the outside, and spoiled it of course. It should be ground or sharpened from the inner edge. Please put it on the saw and you will see that the edge is ground down so that the back part will not let it cut; hence the jumping he speaks of. You will also see that it has never been sharpened on the inner edge — the temper color has not been removed. We would as soon tell a man not to hitch to the tongue of a wagon, after selling him one, as tell him not to grind these cutters on the outer edge. You will find, on grinding back and allowing the edge to be the highest, as it was originally, that this same cutter will beat the best saw (especially when gauged), cutter, or groover you can get. We like fair play, especially when things are so plain as to need no explanation.
>
> If you have time, we would like you to write him and, after grinding the cutter properly, return it to him to convince him. W. F. & JOHN BARNES.
>
> Rockford, Ill.

That the above is somewhat harsh, I am aware; but I have given it you to show that I think there is blame on both sides. Our friend was thoughtless, it is true; but had the cutter been sent him, ground just as it should be, at first, he would have succeeded and been pleased; and if it afterward got out of "rig," he would have known the fault was not in the construction of the implement. I have purchased much machinery, and, I am sorry to say, but little of it has been in really nice working trim when first received. The planer I have mentioned was a pleasant surprise in that respect, for it was almost as sharp and keen as a razor, and every part was as carefully in order as if the maker had fitted it up for his own use. If all kinds of machinery were sent out in just this shape, it would save ever and *ever* so much trouble and bother, and hard words and feelings all round. I know it costs money to do this, and I know it is hard to find a man who will take pride in having every thing just right, no matter what the cost may be; but it should be done. There will be no difficulty in getting a price to cover all expense, after the work has once earned a reputation.

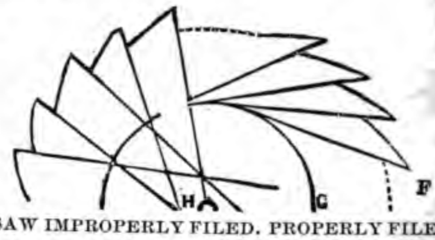
The cutter-head was received, as it was stated. The blue on the steel showed that no file or stone had ever touched it on the inner edge at A, but our friend had ground the outside, in the manner stated. I took the tool to one of our hands who runs saws, explained the matter, and desired him to fix

and try it. As it did not cut very well, I stopped it and looked, and, behold, *he* had not even taken the blue from the steel on the inside.

Messrs. Barnes, I fear there are a great many thick-headed people in this world, and I sometimes have reason to think *I* am chiefest among them. Then what shall we do? I think we shall have to make every thing *very plain*, and I think our tools would all better be sharpened *just right*, before they are sent out, and then purchasers will certainly know how they should be.

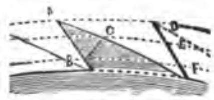
Messrs. Barnes Brothers have sent us a pair of their improved cutter-heads. They are of much nicer finish than their old ones, and there has been some grinding done on the points of the knives; but none of them are ground as they should be to make the best speed in cutting. I think the gentlemen will excuse these criticisms, for I have always found them very ready to adopt any improvement or suggestion I may have made, if a good one. We owe them a vote of thanks already, for having made such great reductions on the prices of almost all kinds of foot-power machinery. The spurs on the cutters sent were too long, and they were of such shape that the block of wood was shaken while being grooved; when they are made so as to be thin sharp blades, cutting about the thickness of a sheet of paper into the wood, in advance of the chisels, with the steel ground back so as not to bump or rub against the sides of the finished groove, your block will stand as steady as if no cutting were being done, and your groove will be beautifully smooth and clean. Best of all, so little power will be required to do the work that you will hardly know the tool is cutting. I know, for I have just stopped my writing an hour, to be sure I could make them go. As I have said before, we use saws instead of these cutters, because, with the constant work we have for them, they would require sharpening so often. A saw has 50 teeth or more, where these tools have but two, to do the work.

Remember, the extreme points of the teeth are to do the work, and no power can be spared in making the saw rub or squeeze through the lumber. No part of the saw should ever touch the lumber, except these extreme points, and they are to be of such shape, and so disposed, that they pare off just enough to let the saw through, and nothing more. If you stand a chisel straight up on a plank, and draw it across it, it may scratch the wood some, but it will not cut it smoothly. If you try pushing it forward at different angles, you will find there is a certain position in which it will make a smooth cut. This is about the angle we wish to give the teeth of a rip-saw. There is a rule for getting this pitch, which you will understand from the diagram below.



SAW IMPROPERLY FILED. PROPERLY FILED.

Let H represent the center of the saw, and F the circumference; G is a line drawn just midway between the center and circumference. Now, if a straight-edge is held against the under side of any tooth, it should lie on the line G. Hold your try-square on the under side of the tooth of your rip-saw, and you can soon see if the teeth are of the right pitch. On the left-hand side you will see some teeth with a wrong angle. Some of them would carry a line toward the center of the saw, and one of them would go past the center on the other side. You need not say no one ever did as bad work as that, for it is not many years since I complained to Mr. Washburn that my saw would not cut well, and he, with a straight-edge, showed me just how badly I had been doing. I had commenced in a hurry, and had filed the saw just to make it do a little for the time being. I had filed both top and front of the teeth to get them to a point "real quick."



HOW SAWS ARE WASTED BY IMPROPER FILING.

Filing a saw on the top of the teeth is a great waste of time, files, and especially saws. Perhaps I can give you some faint idea of the matter from the preceding cut.

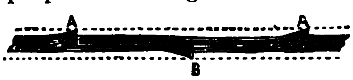
Let A be the point of the tooth when the saw is new; and C, the point where it would be after having been used for a certain amount of work, the filing having all been done on the under side of the tooth so as to leave the line A C just as it was when it was made; that is, it has been untouched by the file, and has worn away only in actual cutting on the wood. The saw has been re-

duced in this way by this amount of work, exactly from D to E. Bear this in mind. Now suppose we have done the sharpening by filing the top of the tooth; in getting the same amount of cutting edge, we should file down from A to B. This would reduce the size of the saw from D to F, instead of from D to E. For filing these small saws from 6 to 10 inches in diameter, we need a file made at just the proper angle like this cut.

The broad side of the file is to be laid on the top of the tooth; it is never to be used for cutting downward, but only to preserve the shape and angles of the top of the tooth, while the cutting is to be done from the under side of each tooth, the top of the tooth being made while sharpening the one just after it.

So much for the shape of the tooth. Our saw must be set, or it will not clear itself through the lumber; and for this purpose we have found the Boynton saw-set as good as any thing for circular saws.

The diagram below will give you an idea of the purpose of setting saws.



THE PHILOSOPHY OF SETTING A SAW.

You will observe that we depend on the little points, A and B, to make a path along the dotted lines, for the blade. If these points get worn off, the saw will pinch, and a great part of the power will be consumed in making it squeeze through the wood. If your saw does not cut easily, this is very likely the trouble. If your lumber is unseasoned or tough, you will need much more set than if you have dry clear tender lumber. Of course, we wish to get along with as little set as we can consistently, for the more wood we cut out, the greater is the power required. Now, another consideration comes in. If we do not set the teeth all alike (and it is almost impossible to do this with any saw-set, on account of the tendency of some teeth to spring more than others) we shall have occasionally a tooth sticking out more than the rest; this causes much friction, and makes our lumber look bad with grooves plowed in it at intervals. For large saws, a side-file is used; but for our work, I think we can level off the points very well with an oil-stone. Lay the stone on your saw-table, against the side of the saw, and turn the saw backward by hand. Now be sure you do not trim the points too much, and that you do not hold your stone so as to make the points wedge-shaped. When done rightly, your saw should cut smoothly and easily, and the stuff should look almost as if it were planed.

In the drawing, I have given about the right angle for the face of the tooth. The point should be almost square, like the end of a chisel; but as the outside corner has by far the greatest amount of work to do, it should be kept a trifle higher. If you give the point of the tooth a very sharp bevel, the saw will leave a point in the wood like this, at A; and if the saw is crowded, the teeth will spring outward somewhat, as shown in the dark lines, making a great amount of friction, and rough and unsightly work. Have plenty of good files at hand, and touch up the teeth of your saws often, if you wish to accomplish the most, with the least amount of hard work.

The above directions are all for rip-saws. A crosscut saw is filed with a 3-cornered file, and needs but few directions different from those already given. As it is always used across the grain, it will work best to have it sharpened so as to leave the point A, as shown in the cut, for this will break off itself. The outer points of the teeth are to be kept very sharp, and are to be leveled up with the oil-stone, so they all cut in the same path. The saw must also be set enough to clear itself, in all kinds of lumber. If you wish to cut up boards that are not perfectly seasoned, you will need to set your saw accordingly. You can, with the Barnes saw, cut off a foot board at one clip, if every thing is all right. Ours is seldom in order to do this, I know; but if I were going to use it, I would keep it in just such order. The grooving-saws for section boxes are to be sharpened like the rip-saws.

SPEED OF CIRCULAR SAWS.

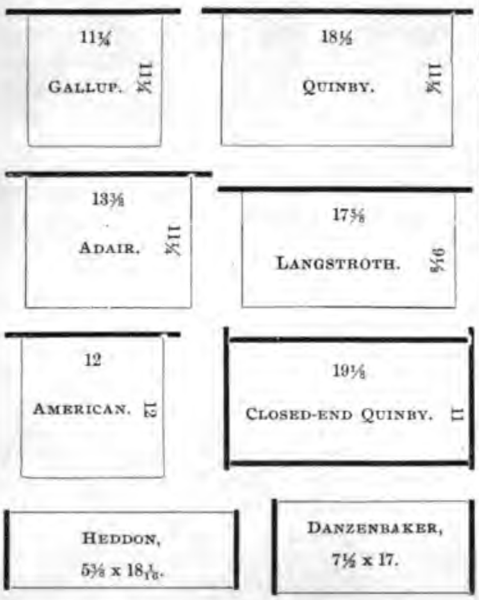
In regard to the speed of circular saws, much depends on the power to be applied, and the material to be cut. As a rule, we may say that the teeth should move at the rate of about 8000 feet per minute. By getting the diameter you can easily figure out the number of revolutions per minute.

HOW TO MAKE A SAW DO AS NICE WORK AS A PLANER.

In the year 1885 we discovered that a rip saw filed with sufficient sharpness and accuracy will cut well-seasoned basswood as

smooth as or smoother than the average planer or sandpapering-machine will make it. The saw is used without any set. It must run absolutely true on the mandrel. The teeth must be filed exactly on the pitch given on page 184, and it may take an experienced saw-filer to do it so that the marks of the teeth will not show on the pieces of wood. The saw must have a high speed—not less than 4000. The stuff must be fed rather slowly, and by a man trained to run a saw without set. You can make the saw do a smooth nice job, my friends, I think, if you sit right down to it and work the matter out. Learn to file your saws, and then learn to run them after they are filed. If you are unpracticed you will crowd the saw, or get the pieces thin at one end and thick at the other; but with practice you can do it every time, saving nearly half the lumber, and a great amount of time, over the old way of first sawing and then planing.

HIVES. I said, under HIVE-MAKING, which we have just passed, that hives based on Langstroth dimensions were the stand-



ard. Some thirty years ago there were in use the American, Gallup, Langstroth, Adair, and Quinby frames. All of these required, of course, hives of different dimensions. Between the Adair, the Gallup, and the American there was but little difference, comparatively, as they were square, and very nearly of a size. The Langstroth was long and shallow—the shallowest frame that had then been introduced; and the Quinby, having about the same proportions, was the largest frame. By consulting the diagram containing the different sizes of frames it will be seen that there are practically two classes—the square and the oblong. As there would be but very little difference, theoretically and practically, between the results secured with a Gallup, American, and Adair, we will consider briefly some of the arguments that were put forth in favor of the square frame.

SQUARE FRAMES — ARGUMENTS IN FAVOR OF.

In nature, bees have a tendency to make a brood-nest in the form of a sphere; patches of brood are more inclined to be circular than square or oblong. Theoretically, then, a circular frame would be the best; but as that would not be practicable, owing to the difficulty in the construction of the frame and hive, obviously the square frame would come the nearest to conforming to nature and a perfect cube for the hive. The square frame, as a rule, called for a hive in the exact shape of a cube. If, for instance, the frame was 12 inches square, outside dimensions, then the hive, if the combs were spaced $1\frac{3}{8}$ inches apart, and $12\frac{3}{4}$ inches wide inside, should take in just nine American frames. Such a hive, it was argued, would conserve the heat of the bees to the best advantage, would give the greatest cubical contents for a given amount of lumber—barring, of course, the perfect sphere. As it economized heat in winter, it would winter bees better than a hive having oblong frames.

All of this seemed to be very pretty in theory; and there are some users of square frames who insist that the theory is borne out by actual experience. But the great majority of bee-keepers, after having tried the square and the oblong frame, finally decided in favor of the Langstroth for the following reasons:

THE LANGSTROTH FRAME AND HIVE, AND WHY THEY BECAME THE STANDARDS.

1. A shallow frame permits the use of a low flat hive that can easily be tiered up one, two, three, and four stories high. This is a great advantage when one is running for extracted honey, for all he has to do when the bees require more room is to add upper stories as fast as the bees require them, and then at the end of the season extract at his leisure. Square or deep hives can not be tiered up very high without becoming top-heavy and out of convenient reach of the operator. 2. The long shallow frame is more

easily uncapped because the blade of the uncapping-knife can reach clear across it. 3. The shape of the Langstroth frames favors an extractor of good proportion. 4. A deep frame is not as easily lifted out of a hive; is more liable to kill bees in the process of removing and inserting frames. 5. The shallow frame is better adapted for box honey. It is well known that bees, after forming a brood-circle, are inclined to put sealed honey just over the brood. In a frame as shallow as the Langstroth, there will be less honey in the brood-nest and more in the boxes; for bees, in order to complete their brood-circle in the Langstroth, will, with a prolific queen, shove the brood-line almost up to the top-bar, and, consequently, when honey comes in, will put it into the supers or boxes just where it is wanted. 6. When bees form their winter cluster they are pretty apt to place it very near the top of the hive or cover. This is on account of the greater warmth at that point, for heated air has a tendency to rise. It sometimes happens, in case of the square frame, that the bees will eat all of the honey or stores away from near the top of the hive; and as the cold weather continues, the bees simply starve, not being able to move the cluster down into the colder part of the hive where the stores are. In the case of the Langstroth, the cluster may be either at the front or rear. As the stores are consumed it will move toward the stores, and still keep within the warmest part of the hive.

But in actual experience bees seem to winter just as well on one frame as on the other; and as the shallow frame is better adapted for box honey, bee-keepers naturally turned toward the shallower frame, with the result that now probably three-fourths of all the frames in the United States are of Langstroth dimensions; and whatever advantage there might be in favor of the square shape, the bee-keeper is able to buy standard goods so much cheaper that he adopts the standard Langstroth frame.

FRAMES SHALLOWER AND DEEPER THAN THE LANGSTROTH.

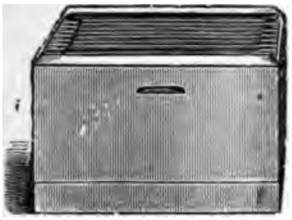
Of late there has been a tendency toward a frame still shallower than the Langstroth, and what is called the Heddon; but as eight or ten of these frames, or one section, make too small a brood-nest, two sets of such frames are used to accommodate a whole colony. Of the Heddon hive I shall have more to say later on.

There is another class of bee-keepers who feel that the Langstroth is not quite deep enough, and who, therefore, prefer the Quinby. They argue that ten such frames, or frames Langstroth length, and two inches deeper, are none too large for a prolific queen, and that these big colonies swarm less, get more honey, and winter better. Of these latter, I shall have more to say under the subject of "Large vs. Small Hives."

THE ORIGINAL LANGSTROTH HIVE.

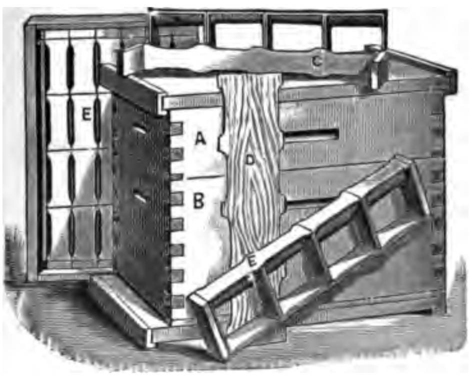
The old original Langstroth hive that father Langstroth put out contained ten frames $17\frac{5}{8}$x$9\frac{1}{8}$. Each hive had a portico, and cleats nailed around the top edge to support a telescoping cover, under which were placed the comb-honey boxes, or big cushions, for winter. There was a time when this style of hive was the only one used; but owing to the fact that it was not simple in construction, that the portico was a splendid harboring-place for cobwebs, and gave the bees encouragement for clustering out on hot days instead of attending to their knitting inside of their hives, a simpler form of hive was devised. The Simplicity, first brought out by A. I. Root, having Langstroth dimensions, was the result. Instead of having telescoping covers the contiguous edges of the hive were beveled so as to shed water and give in effect a telescoping cover. The cover and bottom of this hive were exactly alike, the entrance being formed by shoving the hive forward on the bottom, thus making an entrance as wide or narrow as seemed most desirable. The bottom was made exactly like the cover, so the two could be used interchangeably. The upper story was exactly the same as the lower one or brood-nest—so, taking it all in all, the hive was simplicity itself. But it had one serious defect, and that was the beveled edge. It was found to be practically impos-

sible at times, on account of the bee-glue, to separate the upper story from the lower one without breaking or splitting the bevel. Finally there was introduced a hive very much the same, having straight square edges, and



along with it came the feature of dovetailing or locking the corners, as shown in the hive below.

This hive was introduced in 1889, and seemed to meet with the general approbation of bee-keepers. It embodied in the main the Langstroth dimensions, but used eight instead of ten frames; for at the time it was introduced, nearly every one preferred



eight frames. The original Dovetailed hive had a flat cover, and a bottom-board made the same as the cover, except that there were side-cleats to raise the hive off the bottom-board.

Since that time there have been modifications of the hive, and it is now made in eight, ten, twelve, and sixteen frame sizes. The cover is made of six pieces. The body is locked at the corners, and the bottom-board is made reversible, one side giving an entrance 1¾ inches deep, and the other ⅜ inch. In winter the bottom is adjusted so as to leave a ⅜ width of opening. In hot weather it is reversed so as to give the wide entrance, for it has been found that the ordinary entrance has a tendency to encourage swarming and elustering out.

Another style of bottom-board and hive-stand combined that is getting to be a general favorite for the Dovetailed hive is the one that is shown in the annexed engravings. It consists of side pieces ⅞ of an inch

thick by 4 wide, having grooves on the inner side, running on a slant to receive boards ⅜ inch thick. When the boards are in place, and the bottom-board put together, there will be a bee-space at the rear, of ⅜ inch, increasing gradually up to 1⅛ in front. Mr. S. T. Pettit, Mr. Vernon Burt, and other prominent honey-producers, greatly prefer a bottom-board with a slanting floor—first, because it gives a good wide entrance; and, secondly, because the outside sections are better filled out. Another feature is that the hive proper may be set perfectly plumb and level, and yet the water will run out at the entrance during any beating storm. Still another feature is that this peculiar construction renders the hive-stand unnecessary, because the 4-inch side pieces raise

the hive proper off the ground, away from dampness, and high enough to make it convenient for working. Where the other style

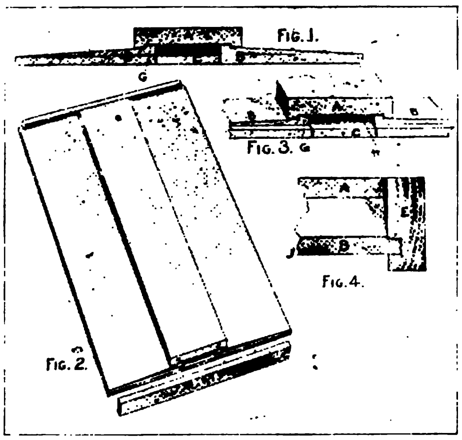
of bottom-board, namely, the Danzenbaker, is used, a hive stand like that shown under ENTRANCES should be used.

The Hoffman self-spacing frame, described under FIXED FRAMES, and FRAMES, MANIPULATING, also under HIVE-MAKING, is used in the Dovetailed hive almost exclusively. The usual width of the hive is eight-frame, although there seems to be a tendency toward the ten and twelve frame sizes. The supers for this hive are the same as those shown under COMB HONEY.

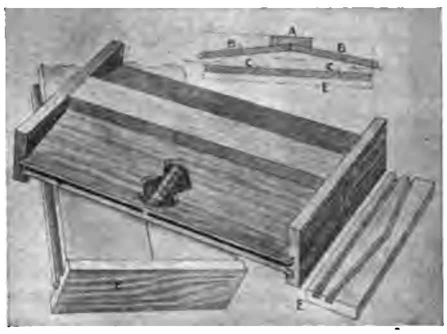
As now constructed the hive embodies the very latest developments in hives and hive-construction. It can be handled rapidly, and is especially adapted for out-apiary work, where frequent moving from one field to another is necessary. It is standard, and

is made by all the supply-manufacturing concerns, and is for sale everywhere. The lock corner is especially well adapted for hot climates; and for any place it is far superior to work depending on nails alone. The ordinary miter or halved joint is inclined to pull apart in parts of California, Texas, Florida, and other portions of our country subject to extremes of heat, or hot dry winds.

A very important requisite of a good hive is a good cover. While the flat cover—one making use of one flat board and two cleats—was a good one, yet, owing to the width of a single board, and its liability to check in hot climates, something made of two or three narrow boards would be better. Accordingly, the Excelsior was devised. It consists of boards not exceeding 6 inches in width, for narrow boards will not shrink and check from the influence of the weather like the wide ones. The center-board, 4½ inches wide, is channeled out on the under side, as shown at H, leaving shoulders at each edge that telescope over corresponding shoulders, as at G, of the two side-boards below. This prevents the water, during a beating rain, from working between the boards, for the very obvious reason that water can not run up hill. The space between the side-boards is filled up with a narrow ⅜-inch strip, and the whole are held together by means of two grooved cleats, such



as have been used for years, and which are heavy enough to hold the cover true and rigid. By putting one nail in the center of each end of the side-boards, as shown, there is no chance for the splitting or checking of the boards at the points of nailing.



In very hot climates a beveled or gabled cover is used. The lower part of the cover is flat, and the upper part gabled, as shown in the accompanying illustration.[467]

HIVES THAT WE RECOMMEND.

The hives we have thus far shown are those that we use and recommend ourselves, because we have tried them on a sufficiently large scale so that we know that we are recommending no experiment. But there are other good hives that are not standard, that may be just as good or better; but as they illustrate certain principles of hive-construction, and as each one of them has some valuable feature, I will endeavor to explain

their general construction and points of merit, without in any sense giving them an indorsement, as fairly and carefully as I know how. We will first have to do with

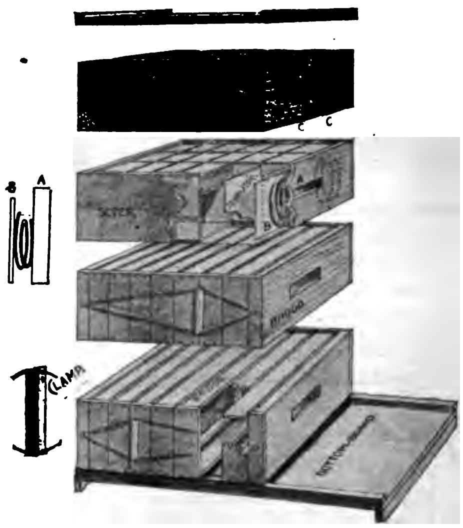
HIVES WITH CLOSED-END FRAMES.

Under FIXED FRAMES, I have spoken of the Quinby, as that is one that is used in Central New York, especially in Herkimer and Otsego Counties. But in this department I shall have more to do with the subject of closed-end frames, certain principles of their construction, and their adjustment in several of the best hives.

Closed-end frames may be divided into two classes — the standing and the suspended. The Quinby, already spoken of under FIXED FRAMES, the Bingham, and the Heddon, are of the first-mentioned classes; the Danzenbaker, to which I shall presently refer, belongs to the latter class. It is generally considered that frames with closed uprights, while not as convenient, perhaps, for general manipulation, are better adapted to wintering. Frames partly closed end, like the Hoffman, or open all the way up, like the ordinary loose hanging frame, permit of currents of air around the ends of the frames, and, as a consequence, bees are not as inclined, so it is claimed, to bring their brood clear out to the end-bars as they do when closed ends are used. Whether there is very much in this I can not say from experience. That there should be any great difference in this respect I have my doubts, although in winter and spring the closed uprights undoubtedly afford better protection. In later years there has been a more marked tendency toward closed-end frames; and whether this is due to their real or theoretical superiority it is hard to say. Time will have to decide.

THE BINGHAM HIVE.

One of the first hives to make use of closed-end frames was the Bingham, which was introduced to the bee-keeping public in 1867, in a form somewhat modified from its present construction. This was very shortly changed to the pattern shown in the illustration. Mr. Quinby was probably the first one to make use of perpendicular end-bars that were closed their entire length. Almost cotemporaneously Mr. Bingham caught hold of the same idea and made a hive consisting of a number of closed-end frames having a top-bar but no bottom-bar. But the peculiar feature of this hive was that it made use of shallow frames only 5 inches deep, a series of them being lashed together by means of a wire loop and stretcher sticks, said loop drawing on the follower-boards in such a way as to bring tight compression on the frames inclosed in the manner shown. Seven of these brood-frames in the present hive make up a brood-nest, and an entire brood-nest may consist of one or two sets of frames. The top-bar is dropped down from the top of the end-bars a bee-space, while the bottom-bars are flush with the bottoms of the end-bars. With a bottom-board having a ⅜-in. strip on each side, the ordinary bee-space is preserved through the several divisions of the hive.



The super is like any ordinary one adapted to comb honey, except that it uses coiled springs to produce the necessary tension.

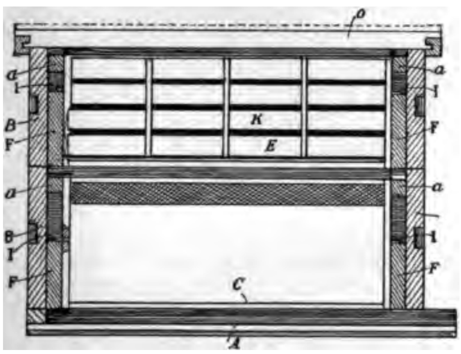
Although Mr. Bingham has used this hive for a great many years, and quite successfully too, no one else seems to have done much with it; but a modification of the hive is shown in the Danzenbaker and the Heddon, both of which, in some sections, have come to be favorites.

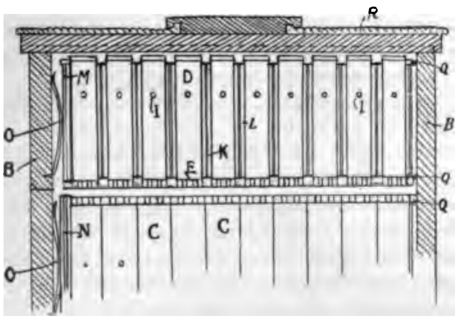
THE DANZENBAKER HIVE.

The Danzenbaker hive, with closed-end frames, is one of the very best; certain it is, it is slowly working its way into the confidence of bee-keepers.[471] It consists of a brood-chamber of the same length and width as the 10-frame Langstroth Dovetailed hive, but only deep enough to take in a depth of frame of 7½ in. The rabbet, instead of being near the upper edge, is dropped down about midway, or, more strictly speaking, there is a cleat or board nailed on the inside of the ends of the hive, as shown at F F in the accompanying

diagram of the hive. On this support hang the closed-end brood-frames, pivoted at the center of the end-bars by means of a rivet driven through from the inside, as shown at I in the diagram. Ten of these frames fill the hive; and when they are crowded together with a follower-board on the side, we

have practically a double-walled hive—the ends of the frames with closed uprights forming one wall, and the ends of the hive the second or outer wall; the follower on one side wall, and the side of the hive the





outside or secondary wall. These frames being pivoted in the center as shown at C, may be reversed, and this feature, when it costs nothing, is something to be desired, as it enables us to have all frames filled solid with comb.

The bottom of these hives is the same as that shown for the Dovetailed, already described; or, to be more exact, the Dovetailed hive has appropriated the bottom-board of the Danzenbaker. The super for comb honey takes in the 4x5 plain section, and makes use of the fence-separator system. The sections are supported in section-holders; indeed, the whole arrangement is the same as the section-holder super already described in COMB HONEY.

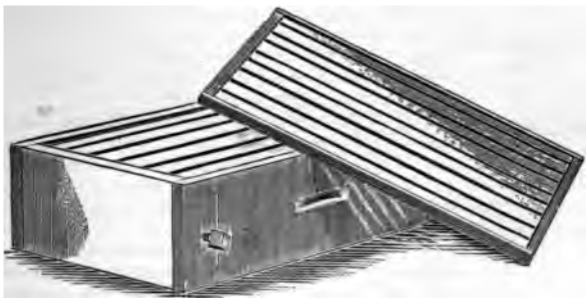
This hive is especially adapted to the production of comb honey, and Mr. Danzenbaker prefers to use only one brood-chamber at a time, although in some localities it might be better to use two. The ordinary Langstroth frame is just deep enough to permit of the bees building from an inch to an inch and a half of honey over the brood in each frame. Mr. Danzenbaker makes his frame just enough shallower so that it will be almost solid with brood, and the honey that would be put in the brood-chamber is forced into the sections just where we want it, and where it will bring the highest market price.

THE HEDDON HIVE.

This hive was patented and introduced by Mr. James Heddon, of Dowagiac, Mich., in 1885. Its peculiar and distinguishing feature is in the use of one brood-chamber divided

into halves horizontally, each half containing a set of eight closed-end close-fitting brood-frames, $5\frac{3}{8}$ in. deep by $18\frac{1}{16}$. The end-bars, as already stated, are close-fitting—that is, the brood-frame slides into the hive with just enough play to allow of its easy removal and insertion. On the bottom inside edge of the ends of each case are nailed strips of tin to support the frames, and the whole set of

eight are squeezed firmly together by means of wooden thumbscrews as shown. Under the head of COMB HONEY I have already spoken of the value of compression for squeezing sections or section-holders or wide frames. The more tightly the parts are held



HEDDON BROOD-CHAMBER WITH HONEY BOARD.

together, the less chance there is for bees to chink propolis into the cracks.

The bottom board of this hive is much like that used on the standard hives, in that it has a raised rim on the two sides and ends, to support the brood-chamber a bee-space above the bottom-board, and at the same time provide for an entrance at the front. The cover is the ordinary flat one-board, cleated at the ends.

As I have already stated, the peculiar feature of this hive is the divisible brood-chamber, not two shallow hives one upon the other, but two *halves* composing one complete whole. The purpose of the inventor in having the hive divided in this way was to afford more rapid handling, and to accomplish contraction and expansion by simply taking from or adding to the brood part of the hive one or more sections. This divisible feature of the hive, according to its advocates, enables them to handle *hives* instead of *frames*, to find the queen by shaking the bees out of one or both of the shallow sections. The horizontal bee-space through the center of the brood-nest is considered an advantage in wintering, in that the bees can move up and down and laterally through the combs.

A very enthusiastic advocate and user of these hives is Mr. W. Z. Hutchinson, editor of the *Bee keepers' Review*, and author of "Advanced Bee Culture." From the last-named work I make the following extract regarding the Heddon hive:

I have no hesitancy in saying that, in my opinion, the new Heddon hive comes the nearest to being the perfect hive of any with which I am acquainted. It is at once the largest or the smallest hive, by simply removing or adding sections. There is no handling of frames nor of "dummies" or division boards. When the brood-nest is contracted the supering surface remains the same. None of the sections are left "out in the cold," so to speak, with "dummies" instead of brood underneath them. The brood can be "spread" whenever it is desirable, by simply interchanging the sections. No handling of *combs* in the operation. The combs can be inverted singly or a whole hive full at one operation. It is a light, readily movable, single-walled hive, and its closed-end frames make it particularly adapted to the establishing of out-apiaries or the moving of bees to secure better pasture. This hive has often been recommended as an excellent one for raising comb honey. It is equally good to use when producing extracted honey. The shallow frames are peculiarly adapted to the tiering-up plan, which is nearly as valuable in raising extracted honey as in raising comb honey. Supers filled with shallow combs may be tiered up and left on the hive for the honey to ripen, when they can be cleared of bees as readily as a case of sections, handled as easily, and when in the honey-house it is only necessary to invert a super, loosen the screws, slip off the case, and there stand the combs all ready for extracting. These shallow combs are uncapped more readily than deep combs.

Some have tried this hive and do not like it. They say they do not find it practicable to shake the bees, especially Italians, out of the sections in order to find the queen; that the hive is too expensive, and at times too slow to manipulate, because there are times when it is necessary to look over each one of the comb surfaces of the 16 little frames composing the one brood-nest. But notwithstanding this there are others who think there is no hive like it.

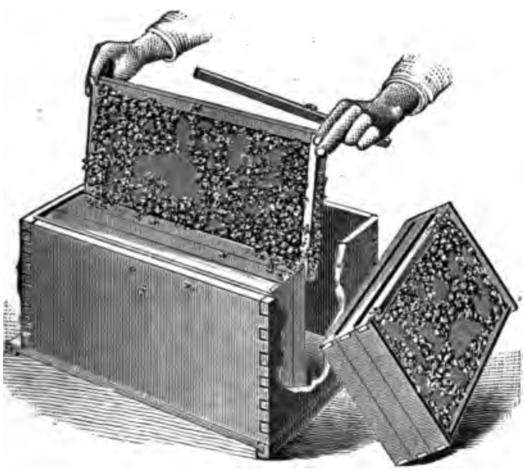
CLOSED-END CLOSE-FITTING FRAMES IN DEEP HIVES.

Under the head of FRAMES, MANIPULATING, I have already shown how it is possible to handle closed-end Quinby frames without killing bees. In the accompanying illustration it will be seen how the ordinary closed ends can be inserted in the hive without killing a bee, even though the end-bars are literally covered with them. The illustration shows a full-depth eight-frame Dovetailed hive with closed-end close-fitting frames. That is, these frames fit in the hive with just enough end play to permit of their easy removal from and insertion into the hive. The plan is this: A frame covered with bees is picked up and set over against the next frame in the hive, in the manner shown. It is then slid down gently, brushing the bees off as it goes down. The other three frames are in-

serted at one operation in the same way. The chief difficulty seemed to be that the frames of this depth would stick, and cause trouble as they went down into the hive-body; but it illustrates *how* frames of the Danzenbaker and Heddon style can be inserted without killing a bee. To be sure, it takes time to do this, but not necessarily longer than it takes to insert unspaced frames.

THE DADANT HIVE.

Almost the very opposite of the Heddon in principle and general construction is the Dadant. While Mr. Heddon divides up the brood-chamber in one, two, or three separate portions, Mr. Dadant would have it all in one large complete whole. His frames are 18¼x11¼—that is to say, they have the Quinby dimensions, and he uses nine or ten



HOW BEE-KILLING MAY BE AVOIDED WITH CLOSED-END FRAMES.

to the hive. Such a hive has about the equivalent capacity of a twelve-frame Langstroth, regular depth. The Dadants have always insisted that their ten-frame Quinbys, when compared with the ten-frame Langstroths, averaged up year after year, would give far better results, both in honey and in economy of labor. This opinion is not based on the experience of two or three years, but on a period covering a good many years. The large hives, they claim, swarm less, produce more honey, and winter better. If I am correct they do not, at their home yard at least, have to exceed two per cent of swarming, and their average has been maintained year after year. Apparently the colonies in these large hives have very little desire to swarm; but when they *do* swarm the swarms are enormous. In regard to this point, in an article that was published in *Gleanings in Bee Culture*, Nov. 1, 1898, C. P. Dadant says:

Don't understand me to say that, with large hives, you will have no swarms, for this is incorrect; but if you want to prevent swarming, to the greatest possible extent, you must, first of all, have large hives. Other things are required, such as the removal of the excess of drone combs, plentiful ventilation, a supply of surplus combs, etc.; but the *sine qua non*, in our eyes, is large hives.

With a little care it is not difficult to keep swarming down to such a point that the natural swarms will barely make up for winter losses. In our case we find it insufficient, and we resort to artificial swarms or divisions, which we find much more satisfactory, for we can breed from the queens that we prefer, and, at the same time, keep our best colonies for producing honey. Every practical bee-man will agree that it is the large colonies that give the large crops, whatever may be his opinion as to the size of hive needed.

But if we *must* have swarms, with large hives they will be large, take my word for it.

The Dadants have claimed that the ordinary eight and ten frame hives are not large enough for good prolific queens; that a brood-frame of Langstroth depth is too shallow; that we never know what a good queen can do till we give her a large hive and a large frame. Again, in one of their articles for Oct. 1, 1898, in *Gleanings in Bee Culture*, Mr. C. P. Dadant says:

With the large hives we found queens that had a capacity of 4500 eggs per day. Exceptions, you will say? Certainly, but it is a very nice thing to give a chance for those exceptions. And I hold that you can not do this as fully with a two-story eight-frame hive as with a hive that may be enlarged, one frame at a time, till it contains all the room that the queen may need. Your eight-frame hive gives her too much room at once when it is doubled in size. If the season is a little cool, there is a chance of delaying the breeding by chilling the combs. The bees will then concentrate themselves upon the brood and keep it within narrow limits, for the queen will seldom go out of the cluster to lay.

As to the matter of wintering, these jumbo hives seem to offer exceptional advantages. Mr. Dadant, in one of these articles, says:

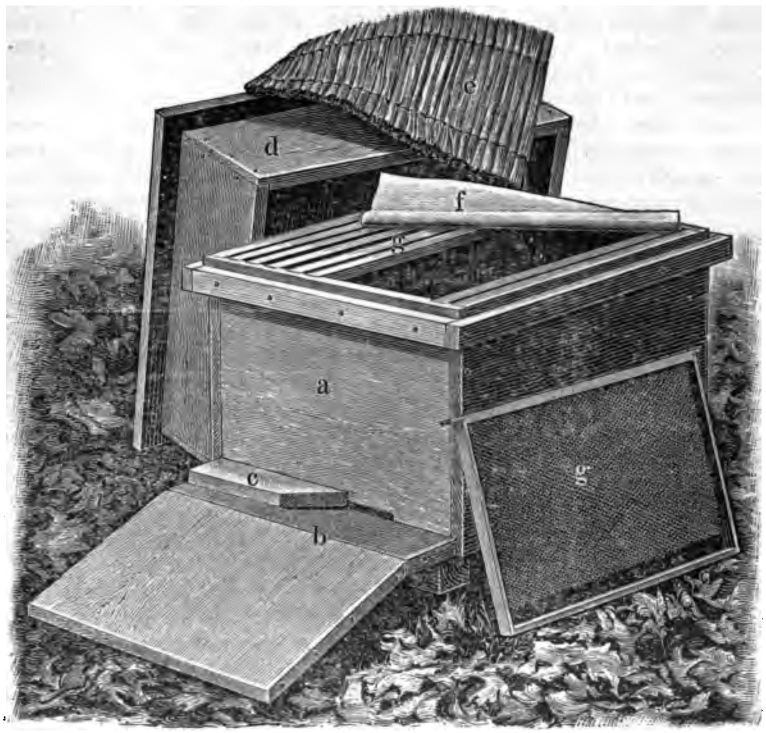
The facts I base myself upon are those that we have seen under our own eyes, of the better success for winter of the large deep hive. . . We have thus stronger colonies for winter, which is in itself a great advantage, as the number of bees has much to do with their ability to keep warm, and their ability to retain the heat has also much to do with their honey consumption. A weak colony suffers much from the cold, and is compelled to eat more. . . But to me the greatest advantage of the deep large frame is in the greater ease the bees have in reaching the honey and in keeping in a more compact cluster.

LARGE HIVES; WHERE AND UNDER WHAT CIRCUMSTANCES USED.

The Dadants have a considerable following in their vicinity; and in France the Dadant-Quinby has come to be almost the standard hive. But it should be remembered that the Dadants are extracted-honey men; and in France liquid honey has rather the preference. There can be no sort of doubt that these large hives, for *extracted* honey, have some advantages over the smaller ones; but when it comes to the production of *comb* honey, then there is a question, and a big one too—is such a large hive as good as a smaller one? In some localities the bees might fill only a brood-nest in such a hive; whereas if a shallower one were used, like the eight-frame Langstroth, the available comb space below would be filled with brood; and the honey, when it did come in, and what little there was of it, would be forced into the supers. In the selection of a large hive, then, a good deal depends on the locality, and whether one proposes to run for comb or extracted honey.

THE LARGE HIVES NON-SWARMERS.

But there is one very important feature in favor of the Dadant hive, or, in fact, any large hive; and that is, the reduction or almost entire control of swarming. There has been no satisfactory method proposed to accomplish this result with the single-story eight-frame Langstroth when run for the production of comb honey; and a great many give up the problem, stating that it is better to let the bees swarm once, and then somehow afterward control the after-swarms, arguing that more actual comb honey will be produced from the parent colony and its swarm than where other methods are employed. But if swarming is to be allowed, what is to be done at outyards? If an attendant has to be constantly on hand during the swarming part of the day, it means a big expense, and this might, in a poor season, balance the entire proceeds of the honey crop. If, on the other hand, swarms are allowed to go to the woods, then there is a loss. It is true that swarms will not escape if the queens' wings are clipped; and to a very great extent clipping does prevent this waste.* But better—far better—is it to take away the desire for swarming altogether, *if* it can be done. In the produc-



DADANT-QUINBY HIVE.

* See CLIPPING QUEENS' WINGS TO PREVENT SWARMING.

tion of extracted honey, at least, the Dadants have demonstrated that, with their large hives, they have practical control of swarming, because their hives are so large that the bees and the queens rarely feel cramped for room. But Mr. Dadant argues that he would use large hives, even if he were running for *comb* honey; for with a division-board he can reduce the brood-chamber to any size desired. And then if he has a prolific queen that can fill a whole Quinby hive he is that much ahead, because the colony has more working bees to its size than a smaller one; and there is no use in denying the fact that these jumbo colonies have a certain vim and energy—a day-after-day "stick-to-it-iveness"—that we do not find in the smaller ones. Personally I believe in large colonies; and I am hopeful that the time will soon come when we shall learn how to make these big colonies produce comb honey as well as, at the same time, remain practically non-swarmers; but at the present time (Jan., 1903) the eight-frame Langstroth hive, single story, has the general preference for comb honey; and this preference seems to cover nearly all the territory in the northern portion of the country—the territory where the main honey supply is almost entirely from clover and basswood.

LARGE COLONIES IN TWO-STORY EIGHT-FRAME LANGSTROTH HIVES.

I have experimented a little with two colonies in eight-frame Langstroth hives tiered one above another, raising brood in both bodies. When we have a good queen, such colonies in such double chambers grow to be tremendously strong, and they show less inclination to swarm—no sort of doubt about that; and, what is more, in a few instances I have placed comb-honey supers on top of these same colonies, and had them fill two and three supers. But in a majority of cases the colonies will not be strong enough to fill two stories and go into the supers besides; so, after getting the colonies up to good strength, and just at the approach of or during the honey-flow, I take away one story and place on one or two comb-honey supers. Such a large force of bees, of course, rush right into them; and if there is any honey in the fields the supers are filled and completed in short order. I have thus far succeeded in getting stronger colonies in this way than in a single eight-frame brood-nest alone. By thus breeding in double stories, and having prolific queens, or, perhaps, what may be better, working colonies on one eight-frame full-depth story, and one eight-frame half-depth story, I can get the bees into the sections at once. For particulars regarding this last, see the Barber plan spoken of under COMB HONEY.

OBJECTIONS TO LARGE HIVES.

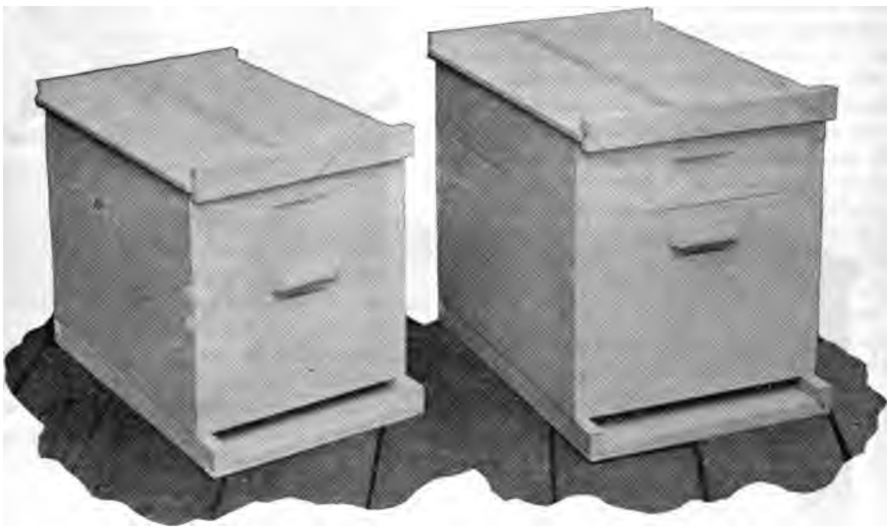
Their size renders them both heavy and unwieldy. They cost more money—about twice as much if made as shown in the engraving of the Dadant hive. It is difficult, in the first place, to get good clear lumber wide enough to make these deep hives; and then when they are made, and are full of bees and honey, it is not practical to move them about much. The Dadants, for instance, leave these large hives on their stands all summer and winter, both at the home and out yards. They find it more practical to do so; and even when wintering on their summer stands in single-walled hives, their loss, I believe, just about equals the slight increase they have in swarming.

These large frames are not nearly as easy to manipulate as the shallow Langstroth. It takes longer to get them out of the hive, and during the operation there is more danger of killing bees. The Dadants and others who use the Quinby find it necessary to use another size frame that they call their shallow, or half-depth, 5⅝x18½, for extracting. These are placed on top of the brood-nest, and are tiered up one, two, three, or four high. One is led to wonder why a compromise between a deep Quinby and these extracting-frames would not be better—a frame adapted for breeding as well as for extracting—as, for instance, one like the Langstroth; then when one wants a large hive he can tier up one brood-chamber on top of the other.

THE TEN-FRAME LANGSTROTH HIVE OF EXTRA DEPTH.

It was suggested by A. N. Draper, of Upper Alton, Ill., one of Mr. Dadant's followers, in order to reduce cost, that, instead of making a hive after the Quinby dimensions, and after the Dadant pattern, the former being odd-sized and the latter expensive to construct, a hive be constructed after the pattern of the regular ten-frame Dovetailed, having Langstroth dimensions save in the one measurement—that of depth. He would add to the hive and frame 2½ inches. As the Dadants ordinarily use nine frames in their Quinby hives, ten frames 2½ inches deeper, with Langstroth top-bar, would give the hive equal capacity. Such a hive would take regular Langstroth ten-frame bottom-

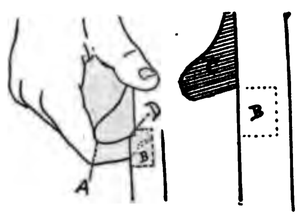
boards, cover, supers, honey-boards, winter-cases—in fact, every thing adapted to the regular ten-frame Langstroth Dovetailed hive. As the ten-frame hive is one of the standards, it seems reasonable to suppose that, if the large hive is really better, such a hive would be more simple, and cost less, than to adopt regular Quinby-frame dimensions, and make the hive as the Dadants show it in the illustration. Indeed, I have been told that the Dadants would favor such a hive rather than the one they have adopted, if they were to start anew. Your supply-dealer will make the brood-chamber for about 25 per cent more than the regular ten-frame Langstroth Dovetailed; the super, covers, and bottom-boards would, of course, cost no more. Where one by reason of locality or preference desires such large hives, the Draper ten-frame Langstroth of extra depth, suitable for taking standard ten-frame fixtures and fittings, would be the hive to select.



THE COMPARATIVE DIFFERENCE IN SIZE BETWEEN A REGULAR EIGHT-FRAME HIVE AND A DRAPER BARN.

CLEATS VS. HAND-HOLES TO LIFT HIVES BY.

By referring to the illustration of the original Langstroth hive on page 188, and also to the illustration of the Dadant hive, page 195, one will see that they have cleats or rims running clear around the hive near the top edge. These serve the double purpose of supporting the telescopic covers and of affording convenient handles by which to lift the hives; but on account of the expense, these cleats running around the hive were in later years abandoned, and hand-holes made by means of a wabble-saw, as explained under HIVE-MAKING, were used instead. But these hand-holes, while very neat and cheap, did not begin to afford the excellent grip that one secures when getting hold of a seven-inch cleat. But a far better arrangement than either is a combination of cleat and hand-hole, as shown in the second illustration of the Dovetailed hive on page 188. A short strip of ⅞-inch molding is nailed just above the hand-hole so that the fingers get a double grip. In the accompanying diagrams the reader will see the advantage of this arrangement. Referring to the diagram at D, when one lifts by the hand-holes alone he lifts by the tips of the fingers only; and when the hive is heavy, the strain on the fingers is severe and often painful. But if he can get the greater part of the weight on the middle joints of the fingers, as shown at A, and on a rounding edge, he can lift all his back will stand. The cleat

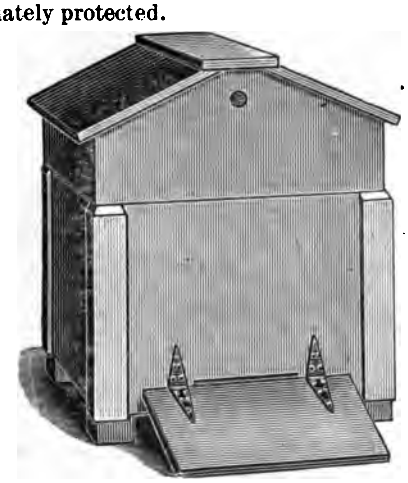


alone would not give room enough for the fingers to permit of the grip on the middle joints, as shown at A; but when the side of the hive is recessed by the hand-hole, it al-

lows of the fingers being shoved to a point to get the best possible grip. If one expects to use heavy hives, then he needs some such arrangement as this. The cost is insignificant, and the advantage great.

DOUBLE-WALLED OR CHAFF HIVES.

The hives that I have thus far described are what may be called single-walled hives; that is, the outer shell or case consists of a single-board thickness of lumber. Such hives, as a rule, unless as large as the Dadant, can not very well be wintered outdoors on their summer stands. They either have to be carried into the cellar at the approach of cold weather, or else have to be put in outside packing-cases, as the single walls hardly afford sufficient protection to enable the average colony to go through the winter safely, or without great loss both in bees and in stores. The poorer the protection, the greater the consumption of winter food. A colony poorly protected outdoors will probably consume twice as much as one adequately protected.



HILTON'S TWO-STORY CHAFF HIVE.

In the South, of course it is not necessary to carry the single-walled hives into the cellar or winter repository; but north of latitude 40, hives of single-board thickness either ought to be housed or protected with winter-cases. Where one from choice or necessity has to winter outdoors, what are known as double-walled or chaff hives should be used. These have the same inside dimensions as the single-walled hive, and are generally made to take the same supers and the same inside furniture. The first double-walled hives that we used were two-story; but they were awkward and unwieldy things compared with the hives of to-day. The one shown in the accompanying illustration represents an eight-frame Langstroth single-story double-walled hive; and as it represents the simplest form of wintering hive, I will describe this only, leaving the reader to adapt it to the dimensions of whatever frame he is using.

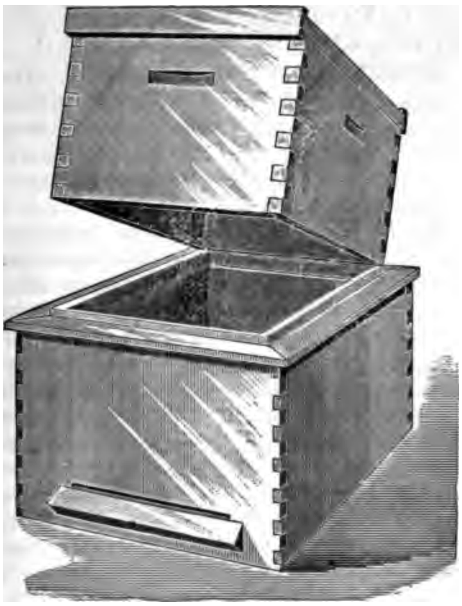
EIGHT-FRAME DOVETAILED DOUBLE-WALLED HIVE.

It can be made large or small; so also the distance between the walls may be increased or diminished in accordance with the demands of the locality in which one lives. The outer wall consists of a shell of ⅜ inch lumber, locked at the corners. This outer shell should be made just large enough to give two inches of space between the walls for packing material. In our locality a packing of two inches seems to answer very well. The inner wall is simply a hive made of ⅜-inch lumber, and is let down in the outer case, and secured to the same by means of a water-table or picture-frame, as we may call it, to shed water. Between the outer and inner walls there is a boxed passageway, as shown, for an entrance.

The raised projection of the water-table is made to fit the upper story of an eight frame Dovetailed hive, or any of the supers or covers of that hive; and in summer the hive may be tiered up as shown in the accom-

panying illustration; and in winter it may be prepared as described under WINTERING, which see.

At our own home apiary we prefer this double-walled hive to the single because it is nearly as light, and because, in our locality, we can leave the colonies in these hives winter and summer. There is no lugging into and out of the cellar; and after the colonies are fed up for winter the preparations for their long winter's sleep and housing are very short, occupying two or three minutes



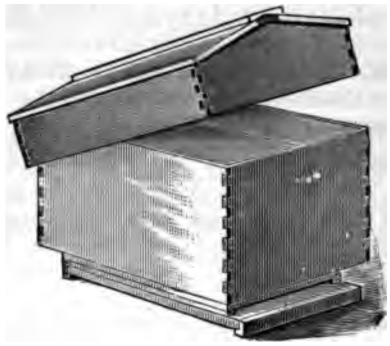
EIGHT-FRAME DOUBLE-WALLED HIVE WITH AN EIGHT-FRAME SINGLE-WALL UPPER STORY.

to a hive. Then the double walls also afford excellent protection in hot weather, in the same way that the two walls and packing material between the walls of a refrigerator prevent a too rapid melting of the ice within.

PACKING MATERIAL FOR DOUBLE-WALLED HIVES.

We formerly used wheat or oat chaff; but as we could not secure this readily we gradually began to use planer-shavings, which we can get more easily. These, we find, answer every purpose, and we now use them exclusively. Forest leaves, if good and dry, would doubtless do just as well, and would have the advantage that they would make the hive, when packed, lighter—that is, easier to lift and handle.

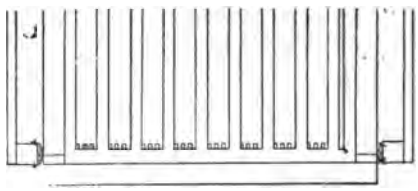
There are a great many who, having in use a large number of single-walled hives, refer to winter on their summer stands, if that can be done. For such there has been devised a winter-case made of ⅞-inch lumber, and just enough larger than the hive to be protected to give one or two inches of



OUTSIDE WINTER-CASES.

packing-space all around the hive. This is placed over and around the smaller hive, the space at the bottom edges between it and the inner hive being closed up with ⅞-inch cleats padded so as to fit the hive closely, as shown in the diagram. Packing material is then poured in and around the hive and on top, when the telescope cover is placed over the whole.

Colonies in such packing-cases winter almost perfectly, and I have no hesitancy in recommending them. But when it comes to



unpacking in spring, they are very inconvenient, to say the least. The packing material has to be pawed out and poured into baskets, when the cover is removed to see if the bees are alive. The packing material tumbles down between the frames, much to the annoyance of the apiarist and discomfort of the bees. For that reason we greatly prefer the regular double-walled hive pure and simple. If the locality is cold enough to warrant wintering in the cellar, I should, of course, use single-walled hives exclusively.

HOARHOUND (*Marrubium vulgare*). This is quite an important honey-plant in Texas. It begins yielding some time in February, and continues to furnish nectar until very late in the summer, or until hot

dry weather sets in. The honey is of a golden color, and of good body, but not a good table honey. It has been said that it is not fit to eat, being very bitter; but Louis Scholl, of Texas, says that this is hardly the case in his locality; that the honey has a very sweet taste, liked by some but nauseating to others. It is said to have pronounced medicinal qualities, and I believe it is used in the pharmacopœia of medicine.

HOLY-LAND BEES. See ITALIANS.

HONEY. Every reader of a work of this kind is supposed, of course, to know what honey is; and yet there may be a good many who have only a superficial idea of it, and perhaps, therefore, a very brief statement should be made.

A sharp distinction should be drawn between the nectar of flowers and honey. The former is a sweet, thin liquid containing an excessive amount of water; a mixture of several kinds of sugar, and perhaps at times a little pollen. Honey, on the other hand, is the nectar of flowers that has been transformed, or digested, by the bees, as Prof. Cook puts it, so that it is fit for human consumption. "A salivary secretion," according to Cheshire, "is added to the gathered nectar, and this, like the saliva in our own case, converts the cane sugar into grape sugar; and probably, also, as with ourselves, this is an initial step in the assimilation, since cane sugar is actually poisonous to the blood, while grape sugar acts within it as a normal producer of heat and force." This supports Prof. Cook's view of digested nectar, and goes to show why many physicians consider honey more wholesome than cane sugar.*

In addition to the chemical change there is a process of thickening, during which the excess of water is evaporated out, leaving anywhere from 15 to 30 per cent. A good ripe thick honey ought not to contain more than 15 per cent of water, and a thin honey perhaps as much as 30.

Scientists are not all agreed as to *exactly* what the bees do do with the nectar in converting it into honey. That some change does take place, and quite a marked one, can scarcely be doubted. Almost any thin sweet liquid, even thin sugar syrup, if fed slowly, will be converted into a sort of honey, although no sugar syrup fed to bees and afterward capped over and put on the market should be sold for honey. While it might, chemically, be a sort of honey, yet it would be a fraud on the consumer, because he would say that he could buy sugar syrup for four or five cents a pound where he would have to pay fifteen to eighteen for the same article after it was converted and sealed in the comb.

But not all nectar receives from the bees the same amount of manipulation or change. Nectar that is gathered rapidly may be stored in the combs when but partly inverted or digested, while at other times the change may be very complete.

For the further consideration of this subject see EXTRACTED HONEY, HONEY-DEW, HONEY AS FOOD.

HONEYS AND THEIR COLORS. The colors of the various kinds of honey vary all the way from nearly black to almost water-white. While the same honey from different localities varies slightly in color, the flavor remains practically the same.

Of the northern white honeys, in the order of their whiteness may be named the willow-herb, of Michigan, and the guajilla, of Texas, which are almost water-white. Next to them in whiteness is mountain sage. Following close on to it is the basswood of all the northern States. Next we have white clover, distributed over even a larger area, comprising nearly all the central and eastern States, and even some of the southern States. Alsike clover is even a trifle lighter, if any thing, than the ordinary white clover; but alsike is obtained only in those regions where farmers have learned the value of this forage-plant. Red-clover honey is a trifle darker than either of the other two, but the flavor is good.

The alfalfa of Colorado and other northern western States resembles in color very much the white clover of the East, and the flavor is considered by many to be better than any other known honey, not excepting white clover. But alfalfa of the southern western States, as for example, Arizona and New Mexico, is more on the amber order, but the flavor is good. The celebrated Canada-thistle honey, over across the border, is another beautiful honey, white in color and exquisite in flavor. Apple-blossom, which was formerly thought to be a dark honey, is now classed as a white; and although the area from which this honey may be obtained is scattered throughout the United States, yet the aggregate amount from this source is very limited. Raspberry honey is another first-class finely flavored white-colored article. We find this honey more particularly in the fruit-growing re-

*See HONEY AS FOOD.

gions. Of the other northern white honeys we have sweet clover, which, while white, has somewhat of a greenish cast. It has a delicate minty flavor that is greatly prized by many. Honey from cucumber, in the pickle-growing regions, is also white, and the flavor is fair.

Of the southern white honeys we have the following: Orange, mangrove, tupelo, and palmetto, of Florida; the marigold and mesquite, the catclaw—a water-white honey—and cotton, of Texas; the mountain sage, Rocky Mountain bee-plant, and alfalfa, in California and Colorado. In the Carolinas we have the sourwood and the gallberry. In Cuba there is the bellflower, or campanilla, which has already obtained quite a reputation for itself. In Jamaica we have the logwood. All of these honeys so far named are white, and vary greatly in flavor. When I say "white" I mean what we call a light honey. Strictly speaking, there is no such thing as water-white nor inky-black honey; but there are gradations of white honeys that vary all the way from a light golden yellow to almost water-white. Of those so far named there will be variations from one extreme to the other. Of the flavors, those in the North are generally regarded as the best. On the other hand, we must not forget that in the South the white honeys are praised as highly as our white clovers, basswoods, and sages.

Of the amber honeys we have the goldenrod, the wild sunflowers, heartsease, aster, Spanish-needle, sumac, and milkweed, of the North; the magnolia, of Florida, and the horsemint, of Texas.

Of the dark honeys, the most prominent is the buckwheat of the East. This honey is produced in nearly all of the north-central States, but more particularly in New York. In that State many people prize it just as highly as they do the best of white clover, and very many prefer it. It has a deep rich purplish color, and a very strong flavor. To one who is used to clover and basswood it is any thing but pleasant,[474] and such honey would sell at a very low price were it not for the fact that there is a very large patronage in the East that prefer the deep dark rich honey of their fathers to any thing else. The honey from poplars and whitewoods is another dark honey, and the flavor is somewhat inferior. See HONEY-DEW.

In a general way we may say that most of the southern honeys **are dark and amber, while most of the northern honeys are white. The nearer to the equator we go, the darker the color and stronger the flavor, although there are marked exceptions, as we have already seen.**

Extracted honey is usually sold by sample in a small bottle or vial sent by mail. Three elements go to make up the price; viz., source, body, and color.

HONEY, ADULTERATION OF. There was a time when adulterated honey was a rare article, but within recent years glucose —a product made of corn, and selling at from 2 to 3 cts. per lb., has been used for adulterating, the amounts of the inferior article ranging as high as from 33 to 75 per cent. Indeed, dark honey — that which would be unsalable simply from its looks — has been adulterated by putting in enough glucose to bring it to a fair color. The temptation is so great to realize large profits, and to improve the appearance of dark-looking honey by putting in glucose, on the part of the dealer, and, in one or two instances, we are sorry to say, of bee-keepers, that far too much impure honey has found its way upon the market.

Glucose itself is a mucilaginous substance, almost water-white in color, with a very low grade of sweetening power. The pure stuff as it comes from the factory has a twangy, brassy, disagreeable flavor, and is unfit to go into the human stomach, even when diluted half and half with honey. But this is not all. Glucose brings down the price of all honeys, as it places the pure article in competition with doctored stuff.

Another substance that is sometimes used for adulterating honey is sugar syrup. But it costs a good deal more than glucose; and the expense of mixing, and the danger of detecting, probably render sugar-syrup adulterations infrequent.

In 1893 one factory alone, according to the daily paper, made 150,000,000 lbs. of glucose, syrups, etc.; and while probably only a small part of this went into honey, there is far too much of it. The problem with bee-keepers is, how to fight the evil. We do not know of any way to do it except to have the suspected samples analyzed, and the mixer of the goods exposed and prosecuted according to law.

Glucose is almost the only adulterant; but, very fortunately, chemists are now able to detect unerringly that product in honey, even where small percentages of it are used. In States like Ohio, where there is a **pure-food law**, and honest, fearless food **commissioners, there is little or no adulteration. In other States, where either is lack-**

ing, adulteration is carried on extensively, much to the detriment of the bee-keeper and consumer. An effort is now being made, looking toward the enactment of a *national* law; and some States, having seen what can be done in Ohio, are about to follow suit.

It is to be hoped that the evil may be handled in some way, as there is probably no one thing that does so much to bring down the price of honey, and disgust consumers, as the vile cheap glucose that disgraces and cheapens otherwise good honey.[475]

A FEW PLAIN FACTS ABOUT GLUCOSE, BY A CHEMIST.

In the *American Bee Journal* there appeared an article by Prof. E. N. Eaton on the subject of honey and beeswax, considered by the Illinois Food Commission. Regarding glucose he writes:

Glucose is produced by the action of dilute sulphuric, oxalic, or hydrochloric acid upon starch, in an open or closed vessel, with or without pressure. The conditions of manufacture govern the quality of the syrup. If the boiling be conducted in an open vessel, only a part of the starch will be converted into dextrose, the remaining portion forming dextrin. This forms the so-called glucose syrup of trade. If the boiling is conducted in a closed vessel under pressure, almost all the starch is converted into dextrose. This product, after treatment and evaporation in vacua, forms the article of commerce known as grape sugar. The liquid product is alone used as an adulterant of honey.

In Germany, potatoes furnish the starch for the manufacture of glucose, but in the United States corn alone is used.

After the starch is converted into "glucose," the acid is destroyed. In case sulphuric or oxalic acid is used, lime is added, forming calcium sulphate (gypsum) or calcium oxalate, and these products being insolvent in the syrup may be separated by filtration. In this country, of late years, hydrochloric acid is generally used in manufacturing glucose, the acid being destroyed by soda-lye, which forms sodium chloride, or common salt, which, while it can not be removed on account of its solubility, is perfectly harmless, and is not in sufficient quantity to affect the taste of the syrup. Hydrochloric acid is also superior to sulphuric acid, as it is less likely to be contaminated with arsenic. The recent wholesale poisoning in England was attributed to arsenic in glucose used in the manufacture of beer. In the manufacture of glucose, English manufacturers use sulphuric acid produced from pyrites, the original source of the arsenic.

Several grades of glucose are marketed, graded by degree of concentration and color. Confectioners' glucose is the best, and almost white in color.

Recently a grape sugar has been placed upon the market consisting of almost pure dextrose, white in color. The product in a granulated form is being somewhat extensively used as a substitute for cane sugar in baking and to mix (I am not aware of its being done fraudulently) with cane sugar. It is a possible adulterant of honey.

Glucose is only one-half as sweet as cane sugar, possesses a characteristic metallic taste, and is miscible in all proportions in water and solutions of other sugars. It does not readily crystallize. It tractably acquires the flavor of the substance with which it is mixed. Its cheapness and general properties make it an excellent adulterant for other sugars. Probably nine-tenths of all adulteration in honey and syrups consists of glucose.

Glucose occurs in nature in combination with other sugars in many fruits and vegetables. An investigation performed at the instance of the United States Department of Internal Revenue resulted in finding glucose as made in this country not in the least detrimental to health; in brief, a proper food.

It may be mentioned that the glucose of to-day is superior to the product investigated by this Commission. Some grades of glucose, especially that intended for Southern trade, are decolorized and preserved by sodium sulphite, a substance not improving the healthfulness of any food into which it enters.

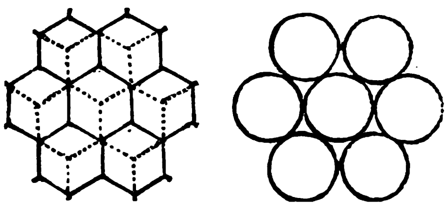
The amount of violent active poisons, sulphuric and hydrochloric acid, lime, arsenic, and other awful drugs that are used in the manufacture of glucose, is such that no consumer, if he knew how it is made or what he is eating, would even taste it. Chemically speaking, a wholly refined glucose is not unwholesome; but the ordinary article, such as is used for adulterating honey, is the very cheapest stuff the glucose-factories can put out. The acid used in its manufacture appears to be not entirely neutralized, or it is over-neutralized by the use of strychnine. If it were not for the beer traffic and the general adulteration business throughout the world there would be no trade or traffic in glucose; and regarding the manufacture of beer I note that Prof. Eaton refers to the recent "wholesale poisoning in England" "attributed to arsenic in glucose used in the manufacture of beer;" and a large part of the American beer as I happen to know (not the hop beer) is a decoction of rank poisons. Any one who can eat some of these so-called decoctions of honey, almost entirely of glucose, must have a stomach of brass or iron.

But there is another point that is quite interesting, for Prof. Eaton says, "Glucose is only half as sweet as cane sugar. It possesses a characteristic metallic taste, and is miscible in all proportions in water and solutions of other sugars."

HONEY-COMB. Everybody knows that the cells of the honey-comb are 6-sided, and I presume most people know why they are 6-sided. If they were square, the young bee would have a much more uncomfortable cradle in which to grow up, and it would take a much greater space to accommodate a given number of bees. This last would, of itself, be a fatal objection: for to have the greatest benefit of the accumulated ani-

mal heat of the brood, they must be closely packed together. This is not only the case with the unhatched bees, but with the bees of a whole colony in winter. When each bee is snugly ensconced in a cell, they occupy less room than they could by any other arrangement.[107]

If the cells were round, they could be grouped together much in the same way as they are now; viz., one in the center, and 6 all around it, equally distant from the central one, and from each other, like the cut, in the figure A; but even then the circles will leave much waste room in the corners, that the bees would have to fill with wax.

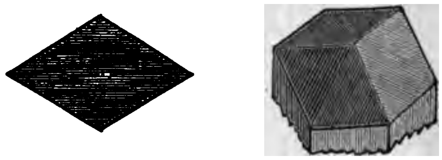


B A

WHY THE CELLS OF THE HONEY-COMB ARE MADE 6-SIDED.

At B we see the cells are nearly as comfortable for the young bee as a round one would be—of course, I mean from our point of view, for it is quite likely that the bees know just what they need, a great deal better than we do; and, at the same time, they come together in such a way that *no* space is left to be filled up at all. The bees, therefore, can make the walls of their cells so thin that they are little more than a silky covering, as it were, that separates each one from its neighbor. It must also be remembered that a bee, when in its cell, is squeezed up, if we may so term it, so as to occupy much less space than it otherwise would; and this is why the combined animal heat of the cluster is so much better economized in winter, when the bees have a small circle of empty cells to cluster in, with sealed stores all around them.[479]

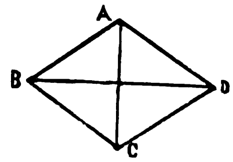
But, my friends, this is not half of the ingenuity displayed about the cell of the bee. These hexagonal cells must have some kind of a wall or partition between the inmates of one series of cells and those in the cells on the opposite side. If we had a plain partition running across the cells at right angles with the sides, the cells would have flat bottoms which would not fit the rounded body of the bee, besides leaving useless corners, just as there would have been if the cells had been made round or square. Well, this problem was solved in much the same way by making the bottom of the cell of three little lozenge-shaped plates. In the figure below we give one of these little



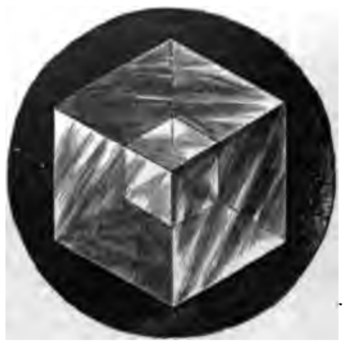
HOW THE BOTTOM OF THE CELL IS MADE.

plates, and also show the manner in which three of them are put together to form the bottom of the cell.

Now, if the little lozenge plates were square we should have much the same arrangement, but the bottom would be too sharp-pointed, as it were, to use wax with the best economy, or to best accommodate the body of the infantile bee. Should we, on the contrary, make the lozenge a little longer, we should have the bottom of the cell too nearly flat, to use wax with most economy, or for the comfort of the young bee.



Either extreme is bad, and there is an exact point, or rather a precise proportion that the width of this lozenge should bear to the length. This proportion has been long ago decided to be such that, if the short diagonal A C of the lozenge is equal to the side of a square, the long diagonal B D should be exactly equal to the diagonal of this same square.



RHOMBIC DODECAHEDRON.

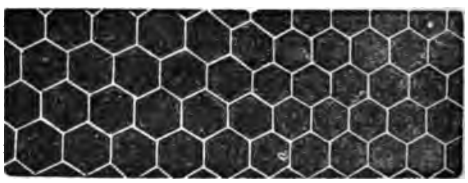
Where the obtuse angles of three of these rhombs meet, as at C, we shall have the exact figure of the bottom of a honey-comb cell. If twelve of these rhombs or surfaces,

as shown by A, B, C, D, be put together, we shall have a solid called the rhombic dodecahedron, as shown below.

How does it come that the bees have solved so exactly this intricate problem, and know in just what form and shape their precious wax can be used, so as to hold the most honey, with the very least expenditure of labor and material? Some are content with saying that they do it by instinct, and let it drop there; but I believe God has given us something farther to do than to invent names for things, and then let them drop. By carefully studying the different hives in a large apiary, we see that not all of them build comb precisely alike, and not all colonies are equally skilled in working wax down to this wonderful thinness. Some bees will waste their precious moments—and wax—in making great, awkward lumps of wax; coarse, irregular cells; crooked, uneven comb, etc., with very bad economy either for the production of brood or for the storing of honey; while others will have all their work so even and true, and so little wax will be wasted, that it is wonderful to contemplate the regularity and system with which the little fellows have labored. Now, it does not require any great amount of wisdom to predict that the latter would, in a state of nature, stand a far better chance of wintering than the ones that were wasteful and irregular in their ways of doing things. If this be the case, those queens whose progeny were best laborers, most skillful wax-workers, as well as most energetic honey-gatherers, would be most sure to perpetuate themselves, while the others would, sooner or later, become extinct. I have found more of a tendency in bees to sport, or to show queer peculiarities, than in any other department of the animal or vegetable kingdom. They vary in color, in shape, in size, in disposition, in energy; and almost every colony, if studied closely, will be found to have some little fashion or way of doing things, different from all the rest in the apiary. Now, when we take into account the fact that many generations can be reared in a single summer, we see how rapidly, by fostering and encouraging any desirable trait or disposition, the bees may be molded to our will. The egg that is laid by a queen to-day may, by proper care, be made to produce a queen laying eggs of the same kind herself, in the short time of only 25 days, as I have explained heretofore. Well, if we should pick out a queen whose progeny made the thinnest comb, and rear others from her, doing the same thing for several generations, we should probably get bees whose combs would break down by the weight of the honey. In a state of nature this extreme would correct itself, as well as the other.

DIFFERENT KINDS OF CELLS IN THE HONEY-COMB.

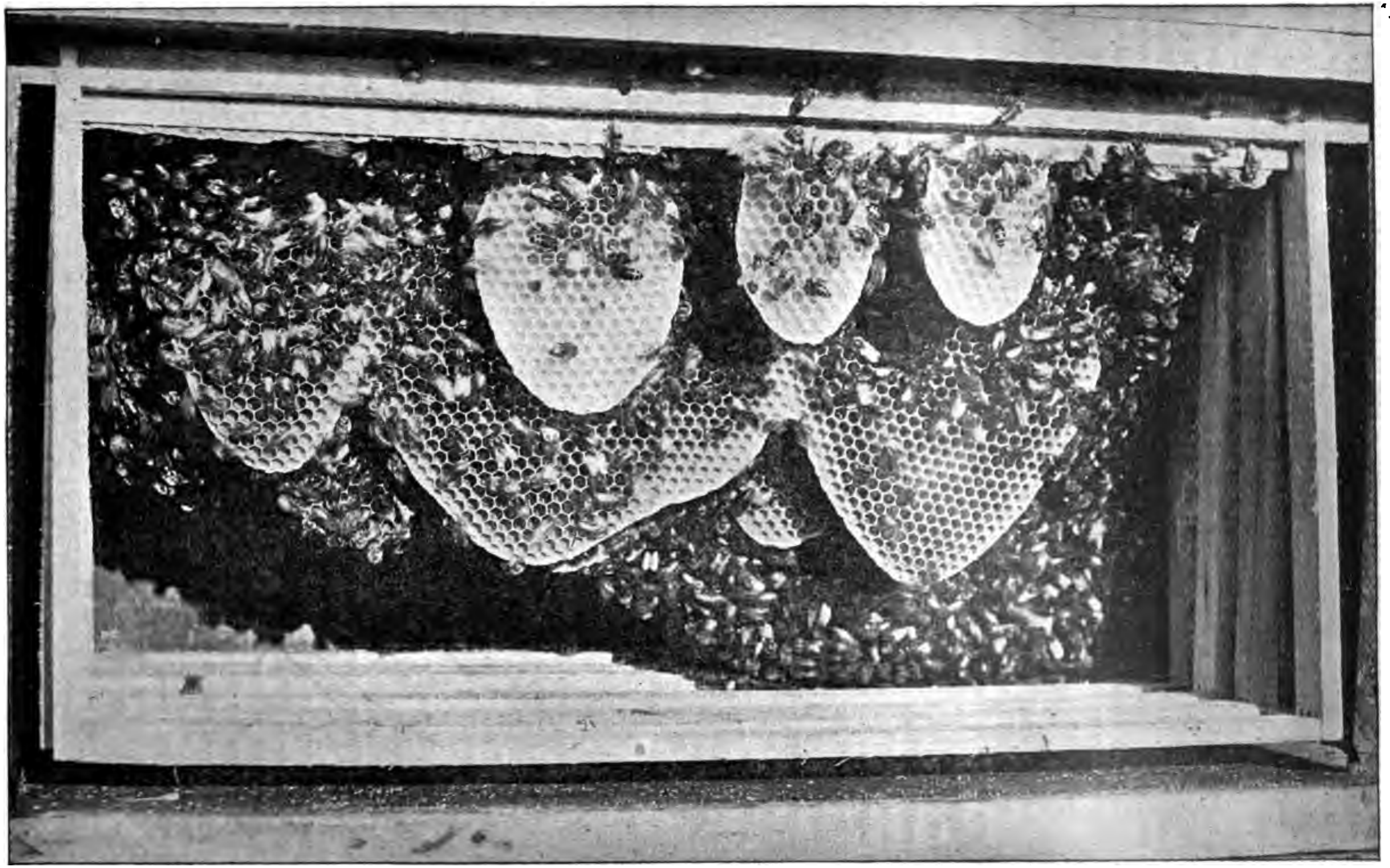
The bees build two distinct, regular sizes—drone and worker cells. The worker-comb measures very nearly five cells to the inch, on an average. Some specimens average a little larger, and some a little smaller; but when the comb is at all irregular, it is quite apt to be a little larger. The best specimens of true worker-comb generally contain 5 cells within the space of an inch, and therefore this measure has been adopted for the comb foundation.[109] If there are five cells to the inch, a square inch would give, on an average, about 25* cells, and 25 on the opposite side would make 50 young bees that would be hatched from every square inch of solid brood. As foundation is so much more regular than the natural comb, we get a great many more bees in a given surface of comb, and here, at least, we can fairly claim to have improved on nature.



DRONE-COMB. WORKER-COMB.

The drone-comb measures just about 4 cells to the inch, but the bees seem less particular about the size of it than with the worker. They very often seem to make the cells of such size as to best fill out a given space; and we, accordingly, find them of all sizes, from worker size all the way up to considerably larger than ¼ of an inch in width. Drones are raised in these extra-large cells without trouble, and honey is also stored in them; but where they are very large, the bees are compelled to turn them up, or the honey would flow out. As the honey is kept in place by capillary attraction, if the cells exceed a certain size the adhesion of the liquid to the wax walls is insufficient, of itself, to hold the honey in place. Where drones are to be reared in

*The exact mathematical calculation makes these numbers 29, 29, and 58, respectively, but ordinarily the numbers I have given in the context are more nearly correct.[483]



NATURAL COMB-BUILDING.—PHOTOGRAPHED BY HUTCHINSON.

these very large cells, the bees contract the mouth, by a thick rim. As an experiment, I had some plates made for producing small sheets of foundation, having only 3½ cells to the inch. The bees worked on a few of these, with these same thick rims, but they evidently did not like the idea very well, for they tried to make worker-cells of some of it, and it proved so much of a complication for their little heads that they finally abandoned the whole piece of comb, apparently in disgust. Bees sometimes rear worker brood in drone-comb, where compelled to from want of room, and they always do it in the way I have mentioned, by contracting the mouth of the cells, and leaving the young bee a rather large berth in which to grow and develop. Drones are sometimes reared in worker-cells also, but they are so much cramped in growth that they seldom look like a fully developed insect.

Several times it has been suggested that we enlarge the race of honey-bees by giving them larger cells; and some circumstances seem to indicate that something may be done in this direction, although I have little hope of any permanent enlargement in size, unless we combine with it the idea of selecting the largest bees to propagate from, as given a few pages back. By making the cells smaller than ordinarily, we can get small bees with very little trouble; and I have seen a whole nucleus of bees so small as to be really laughable, just because the comb they were hatched from was set at an angle so that one side was concave and the other convex. The small bees came from the concave side. Their light, active movements, as they sported in front of the hive, made them a pretty and amusing sight for those fond of curiosities. Worker-bees reared in drone-cells are, if I am correct, sometimes extra large in size; but as to whether we can make them permanently larger by such a course, I am inclined to doubt. The difficulty, at present, seems to be the tendency to rear a great quantity of useless drones. By having a hive furnished entirely with worker-comb, we can so nearly prevent the production of drones that it is safe enough to call it a complete remedy.

HOW THE BEES BUILD THE COMB.

In this day and age of bees and honey, it would seem that one should be able to tell how the bees build comb, with almost as much ease as they would tell how cows and horses eat grass; but for all that, we lack records of careful and close experiments, such as Darwin made many years ago. In our house-apiary, there are dozens of hives where the bees are building right up close to the glass, at this very minute; and all one has to do, in order to see how it is done, is to take a chair and sit down before them. But the little fellows have such a queer, sleight-of-hand way of doing the work, that I hardly know how they do accomplish it.

If we examine the bees closely during the season of comb-building and honey-gathering, we shall find many of them with the wax scales protruding between the rings that form the body, and these scales are either picked from their bodies, or from the bottom of the hive or honey-boxes in which they are building. If a bee is obliged to carry one of these wax scales but a short distance, it takes it in its mandibles, and looks as business-like with it thus as a carpenter with a board on his shoulder. If it has to carry it from the bottom of the honey-box, it takes it in a way that I can not explain any better than to say it slips it under its chin. When thus equipped, you would never know it was encumbered with any thing, unless it chanced to slip out, when it will very dextrously tuck it back with one of its fore feet. The little plate of wax is so warm from being kept under its chin as to be quite soft when it gets back; and as it takes it out, and gives it a pinch against the comb where the building is going on, one would think it might stop a while, and put it into place; but, not it; for off it scampers and twists around so many different ways, you might think it was not one of the working kind at all. Another follows after it sooner or later, and gives the wax a pinch, or a little scraping and burnishing with its polished mandibles, then another, and so on; and the sum total of all these manœuvres is, that the comb seems almost to grow out of nothing; yet no *one* bee ever makes a cell.

The finished comb is the result of the united efforts of the moving, restless mass; and the great mystery is, that any thing so wonderful can ever result at all from such a mixed-up, skipping-about way of working, as they seem to have. When the cells are built out only part way, they are filled with honey or eggs, and the length is increased when they feel disposed, or "get around to it," perhaps. It may be that they find it easier working with the shallow walls about the cells, for they can take care of the brood much easier, and put in the honey easier

too, in all probability; and, as a thick rim is left around the upper edge of the cell, they have the material at hand to lengthen it at any time. This thick rim is also very necessary to give the bees a secure foothold, for the sides of the cells are so thin they would be very apt to break down with even the light weight of a bee. When honey is coming in rapidly, and the bees are crowded for room to store it, their eagerness is so plainly apparent, as they push the work along, that they fairly seem to quiver with excitement; but for all that, they skip about from one cell to another in the same way, no one bee working in the same spot to exceed a minute or two, at the very outside. Very frequently, after one has bent a piece of wax a certain way, the next tips it in the opposite direction, and so on until completion; but after all have given it a twist and a pull, it is found in pretty nearly the right spot. As nearly as I can discover, they moisten the thin ribbons of wax with some sort of fluid or saliva. As the bee always preserves the thick rib or rim of the comb it is working, the looker-on would suppose it was making the walls of a considerable thickness; but if we drive it away, and break this rim, we will find that its mandibles have come so nearly together that the wax between them, beyond the rim, is almost as thin as tissue paper. In building natural comb, of course the bottoms of the cells are thinned in the same way, as the work goes along, before any side walls are made at all.

When no foundation is furnished, little patches of comb are started at different points, as shown in the engraving. Then as these patches enlarge, their edges are united so perfectly that it is sometimes difficult, when the frame is filled solid, to determine *where* the pieces were united, so perfect is the work. At other times there is perhaps a row of irregular or drone cells along the line of the union.

Under COMB FOUNDATION we have already explained how the midrib of natural comb becomes thicker as it approaches the line of support and tapers toward the bottom. Why this is so is evident. That there should be a gradual gradation in thickness from top to bottom seems wonderful when we remember that there is such hap-hazard skip-about work on the part of so many different bees.

For the consideration of the thickness of combs and how far to space them apart see FIXED DISTANCES; also SPACING OF FRAMES; also COMB FOUNDATION.

HONEY-DEW So named because it was formerly supposed that it came down from the heavens in the form of a saccharine spray, settling on the leaves of trees and low-growing shrubbery. It is now known that it is the product of aphides, or plant-lice, and coccids, or scale insects. These are sometimes found in the topmost limbs of the tree, and the honey-dew which they secrete is thrown out as a spray, which falls on the lower limbs and on the sidewalk* or grass. Observers, seeing the leaves of the lower limbs of the trees and the grass covered with a sort of saccharine varnish, naturally came to the conclusion that this substance was a real honey-dew, and hence the name.

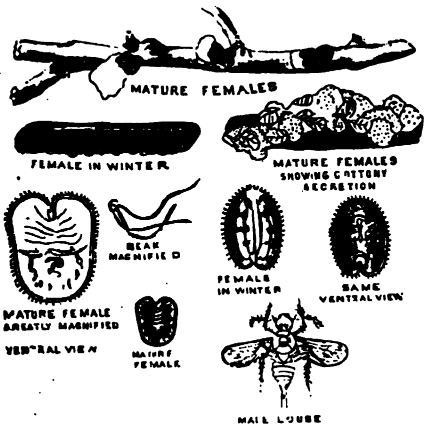
There are certain plants which, under certain conditions, will exude a sort of saccharine substance from the leaves, but, strictly speaking, it is not honey-dew. The ordinary "stuff" that is gathered by the bees, commonly called honey-dew, is nothing but a secretion from plant-lice. There are several species of honey-dew lice, among which may be named *Lecanium tiliæ*, that attacks the basswoods; *Lecanium tulipifera*, of the tulip-tree, often called "poplar," and the scale or bark louse that attacks maple-trees, *Pulvinaria innumerabilis* (Rath.). Prof. Cook, formerly of the Michigan Agricultural College, now of Claremont, Cal., professor of entomology, and a bee-keeper of long experience, thus describes these lice:

> The maple-tree scale or bark louse (*Pulvinaria innumerabilis*, Rath.) consists at this season (1884) of a brown scale about five-eighths of an inch long, which is oblong, and slightly notched behind. On the back of the scale are transverse depressions, marking segments. The blunt posterior of the insect is raised by a large dense mass of fibrous cotton-like material, in which will be found about 800 small white eggs. These eggs falling on to a dark surface look to the unaided eye like flour; but with a lens they are found to be oblong, and would be pronounced by all as eggs, at once. This cotton-like egg-receptacle is often so thick as to raise the brown scale nearly a fourth of an inch. These scales are found on the under side of the limbs of the trees, and are often so thick as to overlap each other. Often there are hundreds on a single main branch of the tree. I find them on basswood, soft and hard maple, and grapevines, though much the more abundant on the maples.
>
> Another feature, at this mature stage of the insect is the secretion of a large amount of nectar. This falls on the leaves below, so as to fairly gum them over, as though they were varnished. This nectar is much prized by the bees, which swarm upon the leaves. If such nectar is pleasant to the taste, as some aver, I should have no fear of the bees collecting it.
>
> From the middle to the last of June, the eggs begin

* Sometimes the sidewalks in our vicinity, in July and August, are spotted all over near the trees.

to hatch, though hatching is not completed for some weeks after it begins, so we may expect young lice to hatch out from late in June till August.

The young lice are yellow, half as broad as long, tapering slightly toward the posterior. The seven abdominal segments appear very distinctly. The legs and antennæ are seen from the other side. As in the young of all such bark-lice, the beak, or sucking-tube,



is long and thread-like, and is bent under the body till the young louse is ready to settle down to earnest work as a sapper. Two hair-like appendages, or setæ terminate the body, which soon disappear.

The same writer, in the *American Bee Journal* for January, 1899, gives his reasons for doubting the plant origin of honey-dew. He says:

1. I now have carefully examined this secretion for years, whenever seen, and have always found either aphides — plant-lice; coccids — scale insects; other hemipterous bugs; or else larvæ of insects (these are reported to me) often working in scores—to be the source of this nectar. This gives strong presumption that such is always the source of honey-dew.

2. We have reason to believe, in the economy of Nature, that energy is never expended by plant or animal that does not in some way benefit by such outgo. We are easily able to see how the insects profit by the secretion of this nectar. They thus lure bees, ants, wasps, etc., to their immediate presence, and these in turn repel the birds which else would feed on and destroy the insects.

I once noticed an exhibit of this function in Michigan, so palpably displayed that to doubt it was impossible. The *Lecanium tiliæ* — a large bark louse— was thick on a linden-tree close beside my study window. In early spring the beautiful song sparrow commenced to feed on the young scale insects which thickly dotted the leaves. Suddenly the bees and other sweet-loving insects commenced to visit the same leaves for the honey-dew which dropped from the coccids, and the birds at once ceased to come. In a few days cold, or, preferably, nectar in other places, kept the bees and their companions from the place, and the birds again commenced their good work. This alternation of bird and bee visits occurred several times. Such observations make the value of the expensive secretion to the insects clearly evident.

On the other hand, the honey-dew always becomes foul with the black smut or fungus that attacks sweet substances on tree or bush. We can hardly doubt that it is a serious evil to the plants, and are unable to see any good that comes to the plant from it. I fully believe it is always harmful to vegetation, and I feel certain that plants do not originate it to their own hurt.

I referred above to certain acorn-infesting larvæ that secrete nectar. I have never seen them, but have often heard of such—principally from Missouri—so often that I think they may be more than a myth. Yet I am free to say that I should feel more certain if I actually saw them. I can see how oak-tree plant-lice, which are by no means rare, might lead to an erroneous conclusion.

Ergot—a fungus which attacks rye and other plants —is also said to secrete honey-dew. If this be true, then I feel sure that the sweet in some way benefits the fungus. If it does the fungus no good, then I believe it, too, has other origin.

In California, where scale insects and aphids are so common, it is very easy to study the honey-dew, and the black repulsive fungus, which our orchardists denominate "smut." The walnut-tree, this season, has been infested generally with an aphid, and the honey-dew and smut have always attended it.

It is not to be inferred that this honey-dew is unwholesome. It is a secretion, and not an excretion. It has a similar origin to honey, and may be as delicious. Much aphid honey-dew is deliciously wholesome, and the honey from it is superior. Most if not all of the coccid honey-dew, on the other hand, is dark and of ill flavor, and its presence in honey, or as honey, is greatly injurious, and can never be sold for the table. I have sold it by the barrel for manufacturing. This was used to make cookies, and was said to be all right by the manufacturer. I explained all to him, yet he gave the ruling price.

Often this honey-dew is produced in exceeding quantities, and I have known it to crystallize on the plants, especially on pine and larch trees, so as to encrust them with white, and become very conspicuous.

Our conclusions, then, which we reach tentatively, are these: Honey-dew is always a secretion from insects.[487] It is always wholesome, and often delicious. It may be produced in exceeding quantities, and become the source of much honey. In such cases, coccid honey-dew honey will often be rank and ill flavored, and should be kept as much as possible by itself, and sold for other purpose than table use. Honey-dew is secreted by insects to serve them in attracting bees, etc., which shall repel the bird enemies of the nectar-secreting insects.

Prof. Cook says "much aphid honey-dew is deliciously wholesome, and the honey from it is superior."[491] That which is secreted on the leaves of hickory is especially fine flavored, and often large quantities of it are gathered and stored by the bees. That which we have in Ohio, and that which I have seen in other localities, is usually of a dark color and rank flavor, to me very sickening and unpleasant, and, as Prof. Cook says, it should be sold to bakers and others desiring an inferior or strong-flavored honey. A good many of the severe winter losses in the past have been attributed to the fact that the bees gathered honey-dew late in the summer or early in the fall, and that the same, proving to be an

unwholesome food, caused dysentery and the final death of the bees. That poor honey-dew has been responsible for winter losses in some cases can scarcely be doubted. We occasionally have it scattered in little patches in our combs; but in late years we have let our bees have all such combs, and no bad results have followed; but if there is very much honey-dew in the combs we extract it and put in its place granulated-sugar syrup. A little mixed with clover or basswood will do no harm.

HONEY ON COMMISSION. See COMB HONEY.

HONEY AS FOOD. About 60 lbs. of sugar on the average is annually consumed by every man, woman, and child in the United States. Of course, many use less than the average, but to make up for it some consume several times as much. It is only within the last few centuries that sugar has become known, and only within the last generation that refined sugars have become so low in price that they may be commonly used in the poorest families. Formerly honey was the principal sweet, and it was one of the items sent as a propitiatory offering by Jacob to his unrecognized son, the chief ruler of Egypt, three thousand years before the first sugar-refinery was built.

It would be greatly for the health of the present generation if honey could be at least partially restored to its former place as a common article of diet. The almost universal craving for sweets of some kind shows a real need of the system in that direction; but the excessive use of sugar brings in its train a long list of ills. Besides the various disorders of the alimentary canal, that dread scourge, Bright's disease of the kidneys, is credited with being one of the results of sugar-eating. When cane sugar is taken into the stomach, it can not be assimilated until first changed by digestion into grape sugar. Only too often the overtaxed stomach fails to perform this digestion properly, then comes sour stomach and various dyspeptic phases. Prof. A. J. Cook says: "If cane sugar is absorbed without change, it will be removed by the kidneys, and may result in their break-down; and physicians may be correct in asserting that the large consumption of cane sugar by the 19th-century man is harmful to the great eliminators—the kidneys—and so a menace to health and long life." See HONEY.

Now, in the wonderful laboratory of the hive there is found a sweet that needs no further digestion, having been prepared fully by those wonderful chemists, the bees, for prompt assimilation without taxing stomach or kidneys. As Prof. Cook says: "There can be no doubt but that in eating honey our digestive machinery is saved work that it would have to perform if we ate cane sugar; and in case it is overworked and feeble, this may be just the respite that will save from a breakdown." A. I. Root says: "Many people who can not eat sugar without having unpleasant symptoms follow will find by careful test that they can eat good well-ripened honey without any difficulty at all."

Not only is honey the most wholesome of all sweets, but it is the most delicious. For the further consideration of this subject see HONEY.

Indeed, in many cases it may be a matter of real economy to lessen the butter-bill by letting honey in part take its place. One pound of honey will go as far as one pound of butter; and if both articles be of the best quality the honey will cost the less of the two. Often a prime article of extracted honey, equal to comb honey in every respect except appearance, can be obtained for half the price of butter, or less. Butter is at its best, only when "fresh;" while honey properly kept remains indefinitely good—no need to hurry it out of the way for fear it may become rancid.

Prof. Cook says: "We all know how children long for candy. This longing voices a need, and is another evidence of the necessity of sugar in our diet. . . . Children should be given all the honey at each mealtime that they will eat. It is safer; will largely do away with the inordinate longing for candy and other sweets; and in lessening the desire will doubtless diminish the amount of cane sugar eaten. Then if cane sugar does work mischief with health, the harm may be prevented."

Ask the average child whether he will have honey alone on his bread, or butter alone, and almost invariably he will promptly answer, "Honey." Yet seldom are the needs or the tastes of the child properly consulted. The old man craves fat meat; the child loathes it. He wants sweet, not fat. He delights to eat honey; it is a wholesome food for him, and is not expensive. Why should he not have it?

Sugar is much used in hot drinks, as in coffee and tea. The substitution of a mild-flavored honey in such uses may be a very profitable thing for the health. Indeed, it would be better for the health if the only hot drink were what is called in Germany honey-

tea—a cup of hot water with one or two tablespoonfuls of extracted honey. The attainment of great age has in some cases been attributed largely to the life-long use of honey-tea.

Aside from its use in an unchanged state as a direct accompaniment of bread or biscuit, honey is used by bakers in manufacturing some of their choicest wares. Carload after carload of cheap extracted honey is used by many of the large bakers in the making of honey-cakes, chief among which is the honey-jumble, a circular cake with a hole in the center. This will keep for months, and even years. There is something about honey that keeps all baked goods made with it soft and moist.* Bakers use honey (and they demand that it shall be strictly pure) because for a certain class of their goods there is nothing to take its place. Honey, they say, requires no glycerine like other sweets, and is therefore cheaper. They prefer also the darker, stronger-flavored honeys, as the milder-flavored article loses its identity or taste in the cake.

Honey is used in medicines, and is the base of many of the cough cures and salves. For candy, honey is far more wholesome than cane sugar.

Very many of the so-called honey cooking-recipes are apt to be worse than nothing; for when the ingredients are put together and made into a cake, the result is simply vile. The recipes given below have been tested, and every one is guaranteed to be good. The honey-jumble recipe, for instance, is especially good, as is the honey-cake recipe by Maria Fraser.

HONEY COOKING-RECIPES.

Honey-gems.—2 qts. flour, 3 tablespoonfuls melted lard, ¾ pint honey, ½ pt. molasses, 4 heaping tablespoonfuls brown sugar, 1½ level tablespoonfuls soda, 1 level teaspoonful salt, ½ pint water, ½ teaspoonful extract vanilla.

Honey-jumbles.—2 quarts flour, 3 tablespoonfuls melted lard, 1 pt. honey, ¼ pt. molasses, 1½ level tablespoonfuls soda, 1 level teaspoonful salt, ¾ pt. water, ½ teaspoonful vanilla.

These jumbles and the gems immediately preceding are from recipes used by bakeries and confectioneries on a large scale, one firm in Wisconsin alone using ten tons of honey annually in their manufacture.

Honey-cake or Cookies without sugar or molasses.—2 cups honey; one cup butter; four eggs (mix well); one cup buttermilk (mix); one good quart flour; one level teaspoonful soda or saleratus. If it is too thin, stir in a little more flour. If too thin it will fall. It does not want to be as thin as sugar-cake. I use very thick honey. Be sure to use the same cup for measure. Be sure to mix the honey, butter, and eggs well together. You can make it richer if you wish by using clabbered cream instead of buttermilk. Bake in a rather slow oven, as it burns very easily. To make the cookies, use a little more flour, so that they will roll out well without sticking to the board. Any kind of flavoring will do. I use ground orange-peel mixed soft. It makes a very nice ginger-bread. *Maria Fraser.*

Howell Honey-cake.—(It is a hard cake.) Take 6 lbs. flour, 3 lbs. honey, 1½ lbs. sugar, 1½ lbs. butter, 6 eggs, ½ oz. saleratus; ginger to your taste. Directions for mixing.—Have the flour in a pan or tray. Pack a cavity in the center. Beat the honey and yolks of eggs together well. Beat the butter and sugar to cream, and put into the cavity in the flour; then add the honey and yolks of the eggs. Mix well with the hand, adding a little at a time, during the mixing, the ½ oz. saleratus dissolved in boiling water until it is all in. Add the ginger, and finally add the whites of the 6 eggs, well beaten. Mix well with the hand to a smooth dough. Divide the dough into 7 equal parts, and roll out like gingerbread. Bake in ordinary square pans made for pies, from 10 x 14 tin. After putting into the pans, mark off the top in ½-inch strips with something sharp. Bake an hour in a moderate oven. Be careful not to burn, but bake well. Dissolve sugar to glaze over top of cake. To keep the cake, stand on end in an oak tub, tin can, or stone crock—crock is best. Stand the cards up so the flat sides will not touch each other. Cover tight. Keep in a cool dry place. Don't use until three months old at least. The cake improves with age, and will keep good as long as you will let it. I find any cake sweetened with honey does not dry out like sugar or molasses cake, and age improves or develops the honey flavor. *E. D. Howell.*

Aikin's Honey-cookies.—1 teacupful extracted honey, 1 pint sour cream, scant teaspoonful soda, flavoring if desired, flour to make a soft dough.

Soft Honey-cake.—1 cup butter, 2 cups honey, 2 eggs, 1 cup sour milk, 2 teaspoonfuls soda, 1 teaspoonful ginger, 1 teaspoonful cinnamon, 4 cups flour. *Chalon Fowls.*

Ginger Honey-cake.—1 cup honey, ½ cup butter, or drippings, 1 tablespoonful boiled cider, in half a cup of hot water (or ½ cup sour milk will do instead). Warm these ingredients together, and then add 1 tablespoonful ginger and 1 teaspoonful soda sifted in with flour enough to make a soft batter. Bake in a flat pan. *Chalon Fowls.*

Fowls' Honey Fruit-cake.—½ cup butter, ¾ cup honey, ⅓ cup apple jelly or boiled cider, 2 eggs well beaten, 1 teaspoonful soda, 1 teaspoonful each of cinnamon, cloves, and nutmeg, 1 teacupful each of raisins and dried currants. Warm the butter, honey, and apple jelly slightly, add the beaten eggs, then the soda dissolved in a little warm water; add spices and flour enough to make a stiff batter, then stir in the fruit and bake in a slow oven. Keep in a covered jar several weeks before using.

Muth's Honey-cakes.—1 gallon honey (dark honey is best), 15 eggs, 3 lbs. sugar (a little more honey in its place may be better), 1½ oz. baking-soda, 2 oz. ammonia, 2 lbs. almonds chopped up, 2 lbs. citron, 4 oz. cinnamon, 2 oz. cloves, 2 oz. mace, 18 lbs. flour. Let the honey come almost to a boil; then let it cool

* Even if the cake should become dry, close it up in a bread-can for a time, and its freshness will return.

off, and add the other ingredients. Cut out and bake. The cakes are to be frosted afterward with sugar and white of eggs.

FOWLS' HONEY LAYER-CAKE.—¾ cup butter, 1 cup honey, 3 eggs beaten, ½ cup milk. Cream the honey and butter together, then add the eggs and milk. Then add 2 cups flour containing 1½ teaspoonfuls baking-powder previously stirred in. Then stir in flour to make a stiff batter. Bake in jelly-tins. When the cakes are cold, take finely flavored candied honey, and after creaming it spread between layers.

FOWLS' HONEY-COOKIES.—3 teaspoonfuls soda dissolved in 2 cups warm honey, 1 cup shortening containing salt, 2 teaspoonfuls ginger, 1 cup hot water, flour sufficient to roll.

HONEY NUT-CAKES.—8 cups sugar, 2 cups honey, 4 cups milk or water, 1 lb. almonds, 1 lb. English walnuts, 3 cents' worth each of candied lemon and orange peel, 5 cents' worth citron (the last three cut fine), 2 large tablespoonfuls soda, 2 teaspoonfuls cinnamon, 2 teaspoonfuls ground cloves. Put the milk, sugar, and honey on the stove, to boil 15 minutes; skim off the scum, and take from the stove. Put in the nuts, spices, and candied fruit. Stir in as much flour as can be done with a spoon. Set away to cool, then mix in the soda (don't make the dough too stiff). Cover up and let stand over night then work in flour enough to make a stiff dough. Bake when you get ready. It is well to let it stand a few days, as it will not stick so badly. Roll out a little thicker than a common cooky, cut in any shape you like.

This recipe originated in Germany, is old and tried, and the cake will keep a year or more.

Mrs. E. Smith.

HONEY DROP-CAKES.—1 cup honey, ½ cup sugar, ½ cup butter or lard, ½ cup sour milk, 1 egg, ½ tablespoonful soda, 4 cups sifted flour.

HONEY SHORT-CAKE.—3 cups flour, 2 teaspoonfuls baking-powder, 1 teaspoonful salt, ½ cup shortening, 1½ cups sweet milk. Roll quickly, and bake in a hot oven. When done, split the cake and spread the lower half thinly with butter, and the upper half with ½ pound of the best-flavored honey. (Candied honey is preferred. If too hard to spread well it should be slightly warmed or creamed with a knife.) Let it stand a few minutes, and the honey will melt gradually and the flavor will permeate all through the cake. To be eaten with milk.

HONEY TEA-CAKE.—1 cup honey, ½ cup sour cream, 2 eggs, ½ cup butter, 2 cups flour, scant ½ teaspoonful soda, 1 tablespoonful cream of tartar. Bake thirty minutes in a moderate oven.

Miss M. Candler.

HONEY GINGER-SNAPS.—1 pint honey, ¾ lb. butter, 2 teaspoonfuls ginger. Boil together a few minutes, and when nearly cold put in flour until it is stiff. Roll out thin, and bake quickly.

HONEY FRUIT-CAKE.—1½ cups honey, ⅔ cup butter, ½ cup sweet milk, 2 eggs well beaten, 3 cups flour, 2 teaspoonfuls baking-powder, 2 cups raisins, 1 teaspoonful each of cloves and cinnamon.

HONEY POPCORN BALLS.—Take 1 pint extracted honey; put it into an iron frying-pan, and boil until very thick; then stir in freshly popped corn, and when cold mold into balls. These will specially delight the children.

HONEY CARAMELS.—1 cup extracted honey of best flavor, 1 cup granulated sugar, 3 tablespoonfuls sweet cream or milk. Boil to "soft crack," or until it hardens when dropped into cold water, but not too brittle—just so it will form into a soft ball when taken in the fingers. Pour into a greased dish, stirring in a teaspoonful extract of vanilla just before taking off. Let it be ½ or ¾ inch deep in the dish; and as it cools cut in squares and wrap each square in paraffine paper, such as grocers wrap butter in. To make chocolate caramels, add to the foregoing 1 tablespoonful melted chocolate, just before taking off the stove, stirring it in well. For chocolate caramels it is not so important that the honey be of best quality. *C. C. Miller.*

HONEY APPLE-BUTTER.—1 gallon good cooking-apples, 1 quart honey, 1 quart honey vinegar, 1 heaping teaspoonful ground cinnamon. Cook several hours, stirring often to prevent burning. If the vinegar is very strong, use part water.

Mrs. R. C. Aikin.

HONEY AND TAR COUGH-CURE.—Put 1 tablespoonful liquid tar into a shallow tin dish and place it in boiling water until the tar is hot. To this add a pint of extracted honey and stir well for half an hour, adding to it a level teaspoonful pulverized borax. Keep well corked in a bottle. Dose, teaspoonful every one, two, or three hours, according to severity of cough.

SUMMER HONEY-DRINK.—1 spoonful fruit juice and 1 spoonful honey in ½ glass water: stir in as much soda as will lie on a silver dime, and then stir in half as much tartaric acid, and drink at once.

HONEY-BOARDS. See COMB HONEY, and HIVES.

HONEY EXHIBITS. See FAIRS.

HOUSE-APIARY. See APIARY.

HONEY-PEDDLING. Under EXTRACTED HONEY, which see, I have already told something about selling direct to consumers. But there are many who say they "haven't the gall or cheek to go around and ask folks to buy," and prefer to be excused from any such disagreeable experience. But there are ways in which one does not need to lose either his dignity or self-respect. A peddler may, it is true, call at unseasonable hours, or steal valuable time from a prospective customer in trying to force a sale. In such ways one may make himself very obnoxious, and render a second visit utterly useless. My friend Dan White, of New London, Ohio, a progressive and practical bee-keeper, has hit upon a novel plan that entirely eliminates all objectionable features. As he has succeeded so well I will let him tell his plan in his own way:

PEDDLING MADE EASY.

I packed my grip and took two 12-pound cans of honey and started out. About all I had in my grip was a good supply of those leaflets published by The A. I. Root Co.; then 50 postals addressed to myself.

I got into the town just before dinner time; and after eating a good meal at a boarding-house I filled my pockets with leaflets and took one honey-can and commenced business. I started down a street and did not miss calling at every house. After ringing the bell, or rapping, a lady would open the door and look at me with more or less suspicion. I would say, "I made the call to ask you if your family were fond of honey."

They generally answered yes, but believed they would not buy any.

"Well," I would answer, "but I am not selling honey to-day. I am giving it away, and should be glad to give you some in a sauce-dish."

Some would look astonished, others would smile, and say, "That's funny," but in *every* instance I was invited in. I would pour out the honey, then hand out a leaflet, telling them to read every word of it. "You will find it very interesting; it will tell you all about honey — how and why we extract it, etc. Then here is a postal addressed to me; and should you decide to want a 12-pound can, put your name, street, and number, on the card; drop it in the office; and when I deliver in about ten days you will get a can of honey."

Well, there were enough cards put in the mail within five days to take thirty cans of honey. I promptly made the delivery on time, taking along twenty extra cans that sold about as fast as I could hand them out; and since then I have received orders for 50 more cans from the same town. I tell you, it has got all over town that a honey-man had been there selling *real* honey, 12 pounds for one dollar. I am certain that this one place will take over 2000 pounds, all in one-gallon cans. Now, then, 18 pounds of honey given away from house to house, 50 postal cards, 200 leaflets left at houses and handed to people on the street, and one day walking over a very small portion of the town, has found a place for at *least* 2000 pounds of honey. Then think what I can do next season should I secure a good crop. All I shall have to do is to take a big load and go up there and hand it out. By the way, the honey sold there was thrown out of clean white combs, over every inch of whose surface the uncapping-knife had to go. It weighed strong 12 pounds to the gallon — just as good as the best comb honey, *only* it was out of the combs. *Of course*, I can go back just as often as I choose; yes, and the people will be glad to see me. DAN WHITE.

New London, Ohio.

It would appear that one of the prime requisites is a first-class article of well-ripened extracted honey. Very many make a mistake right here, and, of course, if the honey is poor, one is not likely to make a second sale. Mr. White's scheme is to have the honey taste *so good* that, when it is gone, the good people will drop that postal for more, and will not haggle over the price, even if the "store stuff" does cost less.

In a similar way Mr. Herman F. Moore, then of Cleveland, O., now of Chicago, retailed large amounts of honey. His plan, like that of friend White, was to go around and solicit orders. In the cities of Cleveland and Toledo, or even those of smaller size, he would start out on foot, exhibiting a sample of his honey in a quart Mason fruit-jar. His reason for using this package was that almost any family would be willing to take a household article of this kind, for the simple reason that it would not have to be thrown away when it had served the purpose of holding the honey.

With this jar of honey Mr. Moore would call at private houses, one after another, and ask for a dish and spoon, saying that he had some very nice honey, and that he would like to give the women-folks a sample to taste. He then held up the beautiful transparent goods to the light, told them he was a bee-keeper, and dealt only in pure honey; explained how it was produced, and finally named the price. If the lady of the house cared to take any he would take her order and deliver the next day. As a rule he took an order.

In this way he would make the rounds of a certain section of the city. When he first began he would take the orders one day and deliver the next; but his business grew so rapidly that he was finally obliged to take on a helper, his brother, and, a little later on, two more men and a man and his wife. The two last named would wash the jars and fill them. Two of the men would deliver while he and his brother took orders. In this way they sold enormous quantities of honey; and as it was always of the finest quality, and guaranteed to be pure, they built up a large trade. Mr. Moore has since removed from Cleveland; and although now a practicing attorney he does considerable at selling honey, either direct to consumers or to the grocers.

Here is another plan, providing one can trade honey for other useful articles too numerous to mention. Even if one did not sell much he would get a day of royal sport. Well, here is the Vinal plan:

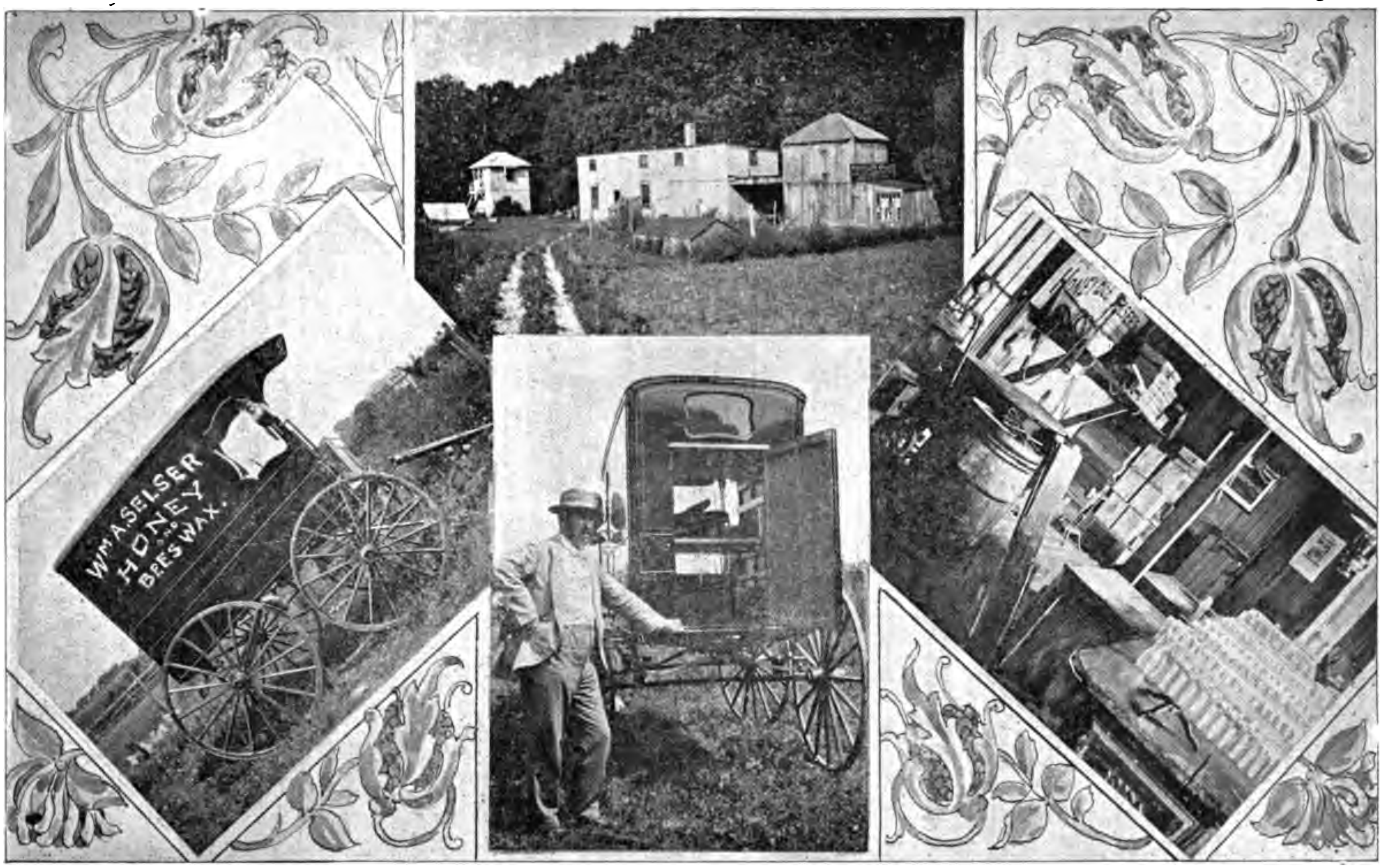
TRADING HONEY FOR DUCKS, PIGS, PUPS, ETC.

In all the literature on bees and honey, we are urged to develop the home market. Acting on the advice, after I had traveled over my regular route this fall I went into an entirely new locality. After enjoying the scenery and the sunlight for about a five-mile drive I called at a farmhouse and inquired of the good lady if she would like some honey.

"Well, yes. I should like some, but I have no money."

Seeing some ducks, I offered to trade honey for ducks; and for a pair I gave four pint jars of honey.

Calling at another house, I sold $2.00 worth for cash; and while I was talking with the man one of the ducks gave a quack, which led to an inquiry as to what I had. I told them I had traded honey for ducks.



SELSER, HIS HONEY-PEDDLING WAGON, AND HIS HONEY-BOTTLING SHOP.

"Well, now, look here; can't I trade you some hens for some honey?"

I traded for half a dozen, and made the children, I hope, happy (I was). In this way I passed the day, and on my drive home I was trying to figure out my profits. I had disposed of two gross of pint jars, and 120 pounds of comb honey. For the pint jars I received 25 cents; also 25 cents each for the sections of comb. I had had a royal day's sport; and as I listened to the quack of the ducks and geese, the cackle of the hens, and squeal of the pigs, and looked at the large box of eggs that I had in the wagon, I thought I would have to send for some of Dr. Mason's egg-preservative. After getting home I took account of stock. I had $54.40 cash, 108 dozen eggs, 8 ducks, 1 goose, 2 pigs, 24 hens, and 1 bullpup. (The pup is for sale.) GEO. L. VINAL.

Charlton City, Mass.

PEDDLING HONEY AT GROCERIES AND OTHER RETAIL STORES.

Mr. W. A. Selser, of 10 Vine St., Philadelphia, is not only a practical bee-keeper, but he is also a large buyer of honey. In addition to the amount he produces in his own apiaries, he buys up every year the product of several large yards. All of this, mostly extracted, he peddles out from a honey-wagon to the retail trade.

The secret of his success in selling and in getting good prices is in putting up always a first-class article in a neat and attractive form. He advertises liberally, and every one knows him about Philadelphia as "the honey-man." In connection with his apiary he has a bottling-shop shown in the top view of the engraving. In a room in this building (see view at the right) he puts up all of his extracted honey in Muth jars. See EXTRACTED HONEY. In this room is a large steam-caldron that will hold perhaps two or three barrels of honey at a time. Into this he pours several choice grades of extracted, whether candied or not. A gentle heat is applied until it is all brought to a liquid condition. It is then heated to about 150 or 180 degrees Fahr., after which it is bottled and sealed while hot. This, as is well known, will prevent the honey from candying for a considerable length of time. The corks, before being put into the bottles, are dipped into a mixture of beeswax and resin and inserted, making a perfectly hermetic sealing.

After several gross, perhaps, are put up, Mr. Selser loads all he can carry in a special wagon shown in the left, and in the central view at the bottom. He then visits the city stores and replenishes their stock. After he has supplied all the city retail places he then goes into the country, visits the suburban towns, and even drives as far as the city of New York, supplying some stores in that metropolis.

HONEY-PLANTS.—Not every flower that blooms helps to fill up our hives. The beautiful flowers of the garden, made double by cultivating them, yield no nectar at all. They produce no seed, so there is no nectar to invite the bees to come and fertilize them. If you will read the article about pollen you will understand this better. Some yield plenty of pollen with little or no nectar. Some yield immense quantities of honey, but the plants are so few in number that they are not worth considering. The poinsettia is an example. I have seen large drops of nectar on one of these plants, which had evaporated to the consistency of honey; but what does it matter how much honey can be obtained from a single plant, if there are no plants except a single one here and there in a greenhouse? Some yield nectar, but the flowers are so constructed that the honey-bee can not obtain it, although some other insect can.

In spite of all this, the list of flowers that are of more or less value to us is a very large one—so large that it is not desirable to give a full list. Throughout the book, in their proper alphabetical places, will be found some account of the principal plants that specially interest bee-keepers. It may be desirable, however, to be able to tell at a glance what they are, so a list is here given.

Included in the list are the names of some that are sometimes spoken of as honey-plants, but are hardly of sufficient consequence to receive much attention, and hence are not mentioned elsewhere in the book.

Abutilon, or flowering maple; an immense yielder, but of no consequence because so scarce.
Acacia; South.
Actinomeris Squarrosa, or golden honey-plant.
Alfalfa, or Lucerne (Medicago sativa), see ALFALFA.
Alsike, or Swedish clover (Trifolium hybridum), see ALSIKE.
Apple, see FRUIT-BLOSSOMS.
Apricot
Asparagus.
Aster (Solidago), see ASTER.
Banana.
Barberry.
Basil, mountain mint (Pycnanthemum lanceolatum).
Basswood, or American linden (Tilia Americana), see BASSWOOD.
Bean.
Bee-balm (Melissa officinalis).
Beggar ticks or burr marigold.
Bergamot (Monarda fistulosa).
Blackberry.
Black gum; South.
Blackheart.
Black mangrove (Avicennia tomentosa); a leading honey-plant in Florida.
Black mustard (Sinapis nigra), see MUSTARD.
Black sage.
Bladder-nut.
Blood-root (Sanguinaria Canadensis).
Blue-bottle.
Blue gum (Eucalyptus globulus); California.
Blue thistle (Echium vulgare).

Bo es t, or thoroughwort (Eupatorium perfoliatum); a honey-plant of considerable importance.
Borage (Borago officinalis).
Box-elder, or ash-leaved maple (Negundo acerodes); where plentiful, quite important.
Buckbush (Symphoricarpus vulgaris); see BUCKBUSH.
Buckeye.
Buckthorn; South.
Buckwheat (Polygonum fagopyrum) see BUCKWHEAT.
Burdock (Lappa major); has white pollen.
Burr marigold (Bidens frondosa); a near relative of the Spanish needle.
Bush honeysuckle
Button-bush (Cephalanthus occidentalis); important on the overflowed lands of the Mississippi River.
Butterweed.
Cabbage.
Cabbage palmetto (Chamœrops palmetto); one of the main s urces of honey in the South.
Cardinal flower (Lobelia cardinalis).
Carpenter's square, see FIGWORT.
Catalpa.
Catclaw; an important honey-plant or tree in Texas; yields large quantities of fine light colored honey.
Catnip (Nepeta cataria).
Chamomile.
Chapman honey-plant (Echinops spherocephalus), see CHAPMAN HONEY-PLANT.
Cherry, see FRUIT-BLOSSOMS.
Chicory.
Chinese wistaria.
Chinquapin.
Clover, alsike, see ALSIKE CLOVER.
Clover, red (Trifolium prateuse), see CLOVER.
Clover, white (Trifolium repens), see CLOVER.
Clover, crimson, see CLOVER.
Cobœa scandens.
Coffee-berry; California.
Coreopsis, see SPANISH NEEDLE.
Corn, Indian.
Cotton (Gossypium herbaceum); South; some say it compares with clover.
Cow-pea; South.
Crab-apple.
Crocus; coming so early, it would be an important plant but for its scarci y.
Crowfoot.
Cucumber (Cu umis sativus); in the vicinity of pick'e-factories this plant yields quite a harvest of honey after clover is over.
Culver's-root.
Currant.
Dandelion (Taraxacum).
Elm (Ulmus): the elms, where plentiful, are of considerable importauce, on account of their aid in early brood-rearing.
Esparcette, or sainfoin, see CLOVER.
False indigo.
Figwort (Scrofularia nodosa), see FIGWORT.
Fireweed, or willow-herb (Epilobium angustifolium): in newly cleared lan s, especially in Northern Michigan, much honey is sometimes obtained from this plant; see WILLOW-HERB.
Fog-fruit (Lippia nodiflora); valued in California and Texas.
Fruit-blossoms.
Gall-berry; South.
Gaura coccinea; well reported in Arkansas.
Germander, or wood-sage.
Giant hyssop.
Giant mignonnette (Reseda grandiflora); see MIGNONNETTE.
Gill over-the-ground, or ground-ivy (Nepeta glechoma), see GILL-OVER-THE GROUND.
Golden honey-plant (Actinomeris squarrosa).
Goldenrod (Solidago).
Gooseberry.
Grape.
Ground-ivy, see GILL-OVER-THE-GROUND.
Guajilla; Texas, see GUAJILLA.
Gumbo, or okra.
Hawthorn.
Hazelnut.
Heal all, see FIGWORT.
Heartsease, or large smartweed (Persicaria mite); on the overflowed lands of the Mississippi this is a valuable fall flower. The honey is quite light colored, and of good flavor. A peculiarity is, that heat injures it so that it is ruined by the temperature of boiling water. See HEARTSEASE.
Heather (Erica vulgaris); a prolific source of honey in Europe and British Isles.
Hemp
Honey-locust (Gleditschia triacanthos).
Hoarhound (Marrubium vulgare); good yields have been reported from this plant, but so bitter as to be worthless except as a medicine.
Hercules'-club (Aralia spinosa).
Horsemint (Monarda fistulosa), see HORSEMINT.
Indian currant, coral-berry, Buckbush (Symphoricarpus vulgaris), see BUCKBUSH.
Ironwood.
Japan clover.
Japanese buckwheat, see BUCKWHEAT.
Japan plum; South.
Japan privet.
Judas-tree, red-bud (Cercis Canadensis).
June-berry, service-berry, shad-berry (Amelanchier Canadensis).
Knotweed, see HEARTSEASE.
Lentils.
Linden, see BASSWOOD.
Locust (Robinia pseudacacia), see LOCUST.
Loosestrife (Lythrum salacaria); good honey-plant, but not plentiful enough to be of much consequence.
Lucerne, see ALFALFA.
Lupine (Lupinus perennis).
Madrona.
Magnolia; South.
Malva.
Mammoth red or peavine clover, see CLOVER.
Mangrove; Florida; a valuable honey-plant.
Manzanita; California.
Maple; the different maples are of much value, yielding well for early brood-rearing.
Marigold (Gailardia pulchella), see MARIGOLD.
Marjoram.
Marsh sunflower.
Matrimony vine (Lycium vulgare).
Meadow sweet.
Melilot (Melilotus alba), see SWEET CLOVER.
Melissa.
Melon.
Mesquite-tree Texas, see MESQUITE.
Mignonnette (Reseta odorata).
Milkweed (Asclepias cornuti).
Milk-vetch
Motherwort (Leonurus cardiaca).
Mountain laurel (Kalmia latifolia); this plant is famed for yielding poisonous honey that produces severe sickness. See POISONOUS HONEY-PLANTS.
Mustard (Sinapis arvensis).
Okra, or gumbo.
Onion Allium cepa); there are reports of yields of honey from fiel s of onions cultivated for seed, having very strongly the puculiar onion odor, which, however, disappears after a time.
Orange (Citrus aurantium); considered valuable in some places.
Ox-eye daisy.
Palmetto; South.
Parsnip
Partridge-pea (Cassia chamœcrista).
Peach
Peavine or mammoth red clover, see CLOVER.
Pepper-tree; California.
Persimmon.
Phacelia; a beautiful cultivated flower.
Plantain, or rib-grass (P antago major) has white pollen.
Pleurisy root (Asclepias tuberosa). This plant is very highly praised by James Heddon.
Plum.
Poinsettia.
Poplar, see WHITEWOOD.
Prairie clover; good in Texas.
Pumpkin.
Radish.
Ragweed, see POLLEN.
Rape (Brassica campestris).
Ratan.
Rattlesnake-root, or tall white lettuce (Nabalus altissimus).
Rattleweed, see FIGWORT.
Raspberry.
Red-bud, Judas tree (Cercis Canadensis).
Red-gum (Eucalyptus ro trata); California.
Rocky Mountain bee-plant (Cleome integrifolia), see ROCKY MOUNTAIN BEE-PLANT.
Sage; black Californi , see SAGE.
Sage (Salvia); white, California.
Sage-button; California.
Saw-palmetto; South.
Shad-bush.
Sida spinosa.
Simpson honey-plant, see FIGWORT.
Snap dragon.
Sneezeweed (Helenium autumnale).
Snowdrop (Symphoricarpus racemosus), see BUCKBUSH.

Spanish needle, see SPANISH NEEDLE.
Spider-flower (Cleome pungens), see SPIDER-PLANT.
Squarestalk, see FIGWORT.
Squash.
St John's-wort (Hypericum).
Stone crop (Sedum pulchellum); South.
Strawberry.
Sumac (Rhus).
Sunflower (Helianthus).
Smartweed, see HEARTSEASE.
Sorrel.
Sorrel-tree, or sorrel-wood.
Sourwood (Oxydendrum arboreum).
Sweet clover (melilotus alba), see CLOVER.
Teasel (Dipsacus).
Thyme.
Tick-seed.
Touch-me-not, or swamp-balsam, see POLLEN.
Trefoil, see CLOVER.
Tulip-tree, see WHITEWOOD.
Turnip (Brassica depressa).
Valerian.
Varnish-tree; South.
Vervain (Verbena).
Vetches.
Viper's bugloss (Echium vulgare), see BLUE THISTLE.
Virginia creeper.
Vitis bipinnata; South.
White mustard (Sinapis alba), see WHITEWOOD.
Whitewood (Liriodendron tulipifera).
White sage, see SAGE.
Wild cherry.
Wild rose
Wild senna.
Wild sunflower.
Wild touch-me not.
Willow (Salix). The willows form a very important class, coming as they do, early in the season, and yielding both honey and pollen.
Willow-herb, see WILLOW-HERB.
Wistaria.
Yellow-wood.

HONEY VINEGAR. See VINEGAR.

HORSEMINT (*Monarda fistulosa*). This plant was first brought to notice several years ago, and at that time the seeds were sold quite extensively as a honey-bearing plant. It was dropped and almost forgotten, until reports of large crops of honey, said to be from this source alone, began to come in. It first attracted attention on the alluvial lowlands bordering on the Mississippi River; afterward, wonderful reports came from it, from different parts of Texas — one man reporting as high as 700 lbs. gathered by a single colony in a single season. The bees that did this wonderful feat were Cyprians, or, at least, crossed with Cyprian blood.

Horsemint in Texas begins to bloom in May or June, and the honey is of good color, and of good body and fair flavor. It is a little strong, and on that account it has been compared with Northern basswood. It is one of the very best honey-plants of Texas. One peculiarity of the flower is that it has very deep corolla-tubes—even deeper than those of red clover, so that bees with long tongues are a desideratum in Texas as well as in red-clover regions of the North.

HYBRIDS. Everybody who has had Italians very long, probably knows what hybrids are, especially if they have kept bees when the honey crop was suddenly cut short during a drought in the fall of the year. The term hybrid has been applied to bees that are a cross between the Italians and the common bee.* If one buys an Italian queen that is pure, he can at once set about rearing queens if he chooses, and it matters not how many common bees there are around him; and if he rears all his queens as I have directed under NUCLEI and QUEEN-REARING, he may have the full benefit of the Italians so far as honey-gathering is concerned, just as well as if there were no other bees within miles of him. This seems a paradox to most beginners, for we have letters almost daily, asking if it will be of any use to purchase Italians, when other bees are kept all around them. If you are keeping bees for the honey they produce, and for nothing else, I do not know but that you are better off with other bees in the neighborhood. The queens that you rear will be full-bloods like their mother; but after meeting the common drones, their worker progeny will of course be half common and half Italian, generally speaking. These are what we call hybrid bees. In looks they are much like the Italians, only a little darker. Sometimes a queen will produce bees all about alike; that is, they will have one or two of the yellow bands, the second and broadest being about as plain and distinct as in the full-bloods. Other queens will produce bees variously striped, from a pure black bee to the finest three-banded Italians. I have had black queens fertilized by Italian drones, and these seem to be hybrids just the same as the others; I have not been able to distinguish any particular difference.

As honey-gatherers, these bees that have the blood of the two races are, I believe, taking all things into consideration, fully equal to the pure Italians. There are times, it is true, when the full-bloods seem to be ahead; but I think there are other times and circumstances when the taint of black blood gives an advantage in respect to the amount of honey gathered, that will fully make up the difference; and I would therefore say, if honey is your object, and nothing else, you are just as well off to let your queens meet just such drones as they happen to find. Why, then, do hybrid queens find slow sale, at about one-fourth of the price of pure Italians? Just because of their excitability and vindictive temper.[114]

Italians, as they generally run, are disposed to be quiet and still when their hive is

*For test as to what constitutes a hybrid, see ITALIAN BEES.

opened, and to remain quietly on their combs while they are being handled, showing neither vindictiveness nor alarm. Black or common bees, on the contrary, are disposed to be frightened, and either make a general stampede, or buzz about one's head and eyes in a way quite unlike the Italians. The Italians do not stand still because they are afraid to make an attack, for, let a robber approach, and they will sting him to death in a way so cool as to astonish one who has seen only common bees under similar circumstances. A race of bees so prompt to repel intruders of their own kind, it would seem, would also be prompt to repel interference from man; but such is not the case. They do not seem to be at all suspicious when their hive is opened, and a frame lifted out. Well, these half-bloods inherit the boldness of the Italians, and, at the same time, the vindictiveness of the blacks. And to raise the cover to a hive of hybrids, without smoke, during a scarcity of honey, would be a bold operation for even a veteran. Without any buzz or note of alarm, one of these sons of war will quietly dart forth and inflict his sting before you hardly know where it comes from; then another, and another, until, almost crazed with pain, you drop the cover, and find that they are bound to stick to you, not only out into the street, but into the house or wherever you may go, in a way very unlike either pure race of bees. Sometimes, when a hive is opened, they will fix on the leg of one's trousers so quietly that you hardly dream they are there, until you see them stinging with a vehemence that indicates a willingness to throw away a score of lives if they had so many. This bad temper and stinging is not all; if you should desire to introduce a queen or queen-cell to these bees, they would be very likely to destroy all you could bring; while a stock of either pure race would accept them without trouble. During extracting time, or taking off surplus honey, you will find little trouble, providing you work while honey is still coming; but woe betide you if you leave it on the hives until the yield is passed.[116]

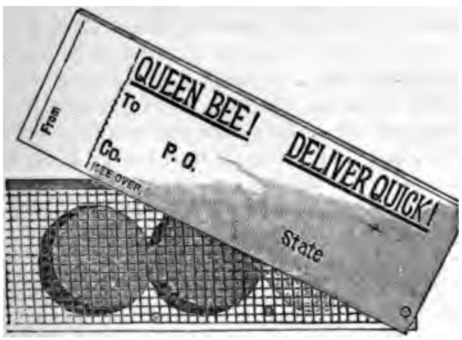
In preparing hybrid stocks for wintering, I have seen them so cross that it was almost impossible to get in sight of the hive, after they had once got roused up; and when I charged on them suddenly with smoker in excellent trim, they charged on me as suddenly, took possession of the smoker, buzzed down into the tube in their frantic madness, and made me glad to beat a retreat, leaving them in full possession of not only the "field," but the "artillery" as well. This was a very powerful colony, and they had been unusually roused up. Although it was quite cool weather, they hung on the outside of the hive, watching for me, I suppose, until next morning. I then came up behind them with a great volley of smoke, and got them under and kept them so, until I could give them chaff cushions, and put them in proper wintering trim.[495] The queen was extremely prolific, and I do not know that I ever had one single queen that was the mother of a larger family of bees. Many of these hybrid queens are extraordinarily prolific.

I believe the hybrids are more disposed to rob than the Italians, but not as much so as the common bees. I decide thus, because, when at work among them, the bees that buzz about the hives, trying to grab a load of plunder if a chance offers, are almost invariably full-blood blacks. They may have a dash of hybrid blood, but I judge not, because the hybrids and Italians will often be at work when the blacks are lounging about trying to rob, or doing nothing. I have known a strong hybrid stock to be slowly accumulating stores in the fall, when full-bloods, in the same apiary, were losing day by day. See ITALIAN BEES.

I.

INTRODUCING. Most of the cages sent out by queen-breeders are accompanied with directions how to perform this operation; and it is usually safer for the beginner to follow these directions implicitly.

The mailing and introducing cage that is ordinarily used over the country is called the Benton, and is shown in the accompanying illustration. This consists of an oblong block of wood with three holes bored nearly through, one of the end holes being filled with



Good candy (see CANDY), and the other two being left for the occupancy of the bees and queen. On the back of the cover are printed the directions for introducing, and at each end of the cage is a small hole bored through the end of the grain of the wood. One hole (next to the bees) is covered with a piece of perforated wire cloth, secured in place by two small wire nails driven through the perforations. The other hole (that is, the candy end) is covered over with a piece of pasteboard perforated by a line of holes running through the center. The object of these perforations is to give the bees an opportunity to taste the candy through the holes of the pasteboard; and once having gotten a sip they will gnaw the holes larger, and finally eat away the pasteboard entirely.

Very often, after the cage has been through the mails, and been on the journey for several days, the bees in the cage will have consumed two-thirds or three-fourths of the candy. If those in the hive to which the queen is to be introduced had access to the candy direct they would eat out what little there was of it in five or six hours, liberate the queen, and probably kill her. In order to accomplish introduction safely the cage should be on the frames (where the bees can get acquainted with the queen) for at least 24 hours, and longer wherever practicable. As it takes anywhere from 12 to 24 hours for the bees to gnaw away the pasteboard before they can get at the candy, and from 6 to 24 hours to eat out the candy, we are assured of at least 18 hours before the bees can release their new mother; and generally the time is longer—anywhere from 24 to 48 hours. The pasteboard has another advantage, in that it makes the introduction entirely automatic. The one who receives the queen pries off the cover protecting the wire cloth, and then by the directions which he reads on the reverse side of this cover he learns that all he has to do is to lay the cage wire cloth down over the space between two brood-frames of the queenless colony, *and the bees do the rest.* It is not even necessary for him to open the hive to release the queen; indeed, he had better let the queen entirely alone for three or four days, for opening the hives disturbs the bees and annoys them to such an extent that very often they will ball the queen, seeming to lay to her door what must be to them a very great disturbance in having their home torn to pieces.

There are several sizes of these Benton cages—the larger ones being used for the longer distances. The one herewith shown is good for 1000 miles through the mails, although it is very often used for twice that distance.

The cage above shown is what may be called a combination mailing and introducing cage. Ordinarily, if we have much introducing to do we prefer something especially adapted to the latter purpose alone; we have, therefore, used with a great deal of satisfaction the cage next shown.

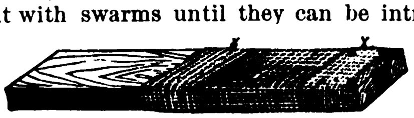
As many of the readers of this work may possibly do something at mailing queens, it may be well to add a word about making the candy for the Benton cages. This should be prepared as directed under CANDY, which see. It should be made several days in ad-

vance of the time it is expected to be used; for after it has been made it will soften down and become quite sticky. If put in cages in this condition it will result in the death of the bees and queen before accomplishing half their journey. After the candy has stood several days it is likely to become soft again, when more sugar should be kneaded in. It would be better then to let it stand two or three days, and then, if necessary, knead in more sugar until it holds its consistency so that the dough is *stiff, moist, and mealy.* This is important. It should then be crowded into the candy hole or candy end, as we call it, and then the hole in the end over which the pasteboard is to be tacked should be plugged full of candy, after which the pasteboard may be nailed on.

The manner of filling the cages for mailing is to pick the cage up in the left hand in such a way that the thumb can cover the hole over which the wire cloth has been nailed, but which, before the time of filling, should be revolved around to one side or taken off entirely. The queen is first to be picked up by the wings, when her head is then to be pushed into the hole as far as possible. She will run in, when the thumb is to be put over the hole. A worker-bee is next to be picked up in a similar manner, and poked in. Workers are put in in this way, selecting those that are filling with honey from some empty cells until there are a dozen bees. If the cage is larger, two dozen may be used; and if it is extra large, four or five dozen. If the cages are mailed during cold weather there should be more bees put in, to help keep up the animal heat; but during hot weather there should be no more than a dozen bees in the smallest Benton cage, which is ordinarily mailed for a cent.

MILLER'S INTRODUCING-CAGE.

It is very convenient to have in the apiary small cages for introducing, as well as for caging and holding queens that come out with swarms until they can be intro-



duced or disposed of. The one above illustrated is the best of any. It is especially handy for introducing young virgins.[499] The cage is so flat it can be slid in at the entrance, without even removing the cover of the hives, and the bees will release the queen by the candy method. **But when introducing fertile or valuable queens I would recommend inserting it between two combs. Draw them together until they hold the cage. The queen thus acquires the scent of the combs, brood, and of the cluster, and hence when released will be more likely to be accepted.**

This cage, like the Benton, will give very much better results if a piece of pasteboard be nailed over the end. This the bees will gnaw away, gaining access to the candy, which they eat out. We have found that, since we have discovered the value of the pasteboard used in the manner stated, with either the Benton or the Miller cage we are able to introduce 99 per cent of all the queens, providing, of course, the colony has not been queenless more than four or five days. One that has been without a mother longer may get to depending on cells; and when the work has so far progressed they are liable to destroy the introduced queen and await the hatching of one of the virgins.

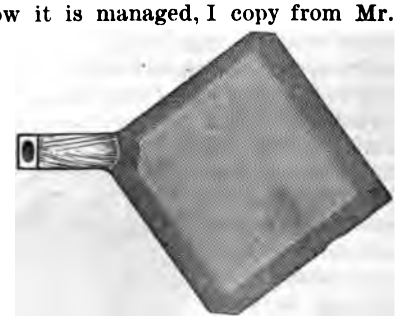
I copy its manner of construction from Dr. Miller's own words:

Take a block 3 inches long, $1\frac{1}{4}$ wide, and $\frac{3}{8}$ thick; two blocks 1 inch by $\frac{7}{16}$x$\frac{3}{8}$; two pieces of tin about an inch square; a piece of wire cloth $4\frac{1}{2}$x$3\frac{1}{2}$; two pieces of fine wire about 9 inches long, and four small wire nails $\frac{1}{2}$ or $\frac{5}{8}$ long. That's the bill of material. Lay down the two small blocks parallel, $\frac{3}{8}$ of an inch apart, one piece of tin under, and one over them. Nail together and clinch. These two blocks, being $\frac{3}{8}$ inch apart, make the hole to fill with Good candy, through which the queen is liberated.

For an introducing-cage this is ahead of any thing else I know of. In our apiaries we use it exclusively. Another feature of importance to beginners is as a queen-catcher. It can be set down over the queen after the wooden slide is removed, and when she crawls upward the plug is replaced.

M'INTYRE'S CAGE.

Another excellent introducing-cage is the one devised by J. F. McIntyre. As to how it is managed, I copy from Mr. Mc-



Intyre's article in *Gleanings in Bee Culture*, page 880, 1890:

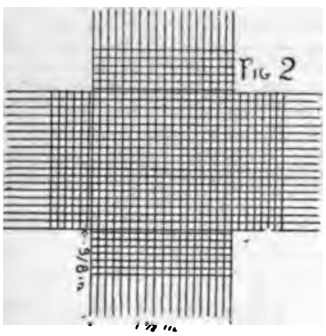
I take a piece of wire cloth $5\frac{1}{2}$ inches square, cut little pieces $\frac{3}{4}$ of an inch square out of each corner,

and bend the four sides at right angles, making a box 4 inches square and ⅜ inch deep. In one corner I fasten a tube of wood or tin ⅜ inch in diameter, and two inches long, which is filled with Good candy, for the bees to eat out and liberate the queen.

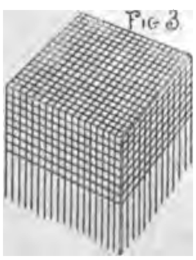
I use this cage altogether in my apiary, for changing laying queens from one hive to another. I kill my old queens when they are two years old, and introduce young laying queens in their places. My practice is to go to the nucleus with the young laying queen; lift out the comb with the queen on, and press one of these cages into the comb over the queen, and what bees may be around her.[349] Carry this comb to the hive with the old queen; find and kill the old queen, and place the comb with the young queen caged on it in the center of the hive, taking one comb from the hive back to the nucleus. In a week I go and take the cage out and find the young queen laying. When I receive a valuable queen from a distance I liberate her at once on a comb of hatching brood, with some young bees; and when she commences to lay I introduce her as above.

Fillmore, Cal., Oct. 21. J. F. McINTYRE.

A cage that is very popular with many bee-keepers, and somewhat similar to the foregoing, is shown in the two illustrations next following. From a piece of wire cloth



perhaps 6 inches square a piece 1½ inches is cut out of each corner, as shown in Fig. 2. Several strands of wire are then raveled out, and it is then folded as shown in Fig. 3. To introduce, the queen is placed on a patch of hatching brood with a few cells of honey. When she is at the right point the cage is clapped over her, and the strands are forced clear up to the cross-wires. The young bees, as they hatch, will treat her kindly, and in the mean time she will begin laying in the cells vacated by the bees. If the outside bees seem to be favorably disposed, in two days the cage may be pulled off; and if the bees still treat her kindly, the comb can be put back



into the hive, and the hive closed up. If the bees show any disposition to ball her, she should be caged again as before, but this time all unsealed larvæ should be removed, and care should be taken that there are no queen-cells of any kind. In from three to five days more she may be released again. By this time the bees will be almost sure to accept her.

The difference between this and the McIntyre cage is that the apiarist has to release the queen himself, whereas by the McIntyre plan the bees eat out the candy and liberate her automatically. The latter plan is to be preferred, because sometimes opening the hive will so disturb the bees as to cause them to attack the queen.

HOW TO TELL WHETHER A COLONY IS QUEENLESS OR NOT.

Having discussed mailing and introducing cages, it may be pertinent at this point to give one of the prime essentials to successful introducing. The very first thing to be determined before you attempt to introduce at all, is that your colony is *certainly* queenless. The fact that there may be no eggs nor larvæ in the hive, and that you can not find the queen, is not sufficient evidence that she is absent, although this state of affairs points that way. But during the earlier part of the summer there should be either brood or eggs of some kind if a queen is present. Yes, there should be eggs or brood clear up until the latter part of summer. In the early fall, queens very often stop laying, and shrivel up in size so that a beginner might conclude that the colony is queenless, and therefore he must buy another. In attempting to introduce the new queen, of course he meets with failure, and the new arrival is stung to death, in all probability, and carried out at the hive-entrance. If you can not find either eggs or larvæ at that season of the year when *other* stocks are breeding, and the supposedly queenless colony build cells on a frame of unsealed larvæ that you give them, you may decide that your colony is surely queenless, and it will be safe then to introduce a new queen. If you find eggs, larvæ, and sealed *worker* brood, the presence of queen-cells simply indicates that the bees are either preparing to supersede their queen, or making ready to swarm. See SWARMING.

HOW LONG SHALL A COLONY BE QUEENLESS BEFORE ATTEMPTING TO INTRODUCE?

The worst colony to introduce a laying

queen to is one that has been queenless long enough so that there is a *possibility* of one or more virgin queens being in the hive. It is hard to decide definitely in all cases when such colonies are queenless. The young virgins, after they are three or four days old, are very apt to be mistaken for workers, especially by a beginner. It is not always practicable to wait until they will build queen-cells, especially if you happen to have a nice surplus of laying queens which you wish to find room for. We prefer colonies that have not been queenless more than a couple of days — just long enough to see cells start, and just long enough so the bees begin to recognize their loss, but not long enough for them to get cells under way. Cells nicely started or capped over are quite apt to make the colony feel as if it wanted something of its own; and when a laying queen is introduced to them they take a notion sometimes that they *won't* have a strange mother.

WHAT TO DO IF BEES BALL THE QUEEN.

When we introduced queens in the old-fashioned way—that is, before cages were constructed so as to release queens automatically — we used to experience much trouble by bees balling queens. If the bees were not ready to accept her when she was released by the apiarist, they were pretty sure to ball her. But here is a point that it is well to observe: When the *bees* let the queen out they will rarely ball her. But when it is necessary for the *apiarist* to perform the work, the opening of the hive, accompanied by the general disturbance, is apt to cause the bees to ball her as soon as she is released. Well, suppose they do ball her. Lift the ball out of the hive and blow smoke on it until the bees come off one by one. When you can see the queen, get hold of her wings and pull the rest of the bees off from her by their wings. Do not be nervous about it, and you can get her loose and cage her again. Put more candy in the opening, and give her another trial. Some one — I do not remember who — advised dropping the queen, when she is balled, into a vessel of water. The angry bees will immediately desert her, when the queen can be easily taken out of the water, and recaged. We have never tried it, but I believe we should prefer the method we first described.503

WHAT TO DO WHEN THE QUEEN FLIES AWAY.

Sometimes a beginner is very nervous, and by a few bungling motions may manage to let the queen escape from the hive where he expects to introduce her. Or this may happen: The queen may take wing right off from the frame—become a little alarmed because there are no bees about her, and fly. In either case, step back immediately after opening the hive, and in fifteen or twenty minutes she is quite likely to return to the same spot, and you must not be surprised if you find her again in the hive. If you do not discover her in the hive near where you are standing, in about half an hour look in other hives near by. If you see a ball of bees somewhere down among the frames, you may be quite sure that she is the queen that flew away, and that she has made a mistake, and entered the wrong hive.

A SURE WAY OF INTRODUCING.

There is one perfectly sure way of introducing a very valuable queen, such as an imported one, if we only observe the conditions carefully. Remove frames of hatching brood from several hives, and shake off every bee; put these into an empty hive, closing it down to a small space; and if the weather is not very warm, place the whole in a warm room. Let the queen and her attendants loose in this hive, and the young bees, as they hatch out, will soon make a swarm. As several who have tried this plan have been so careless as to leave the entrance open and let the queen get out, I would warn you especially to have your hive so close that no bee can by any possibility get out.* If the frames you have selected contain no unsealed brood, then you will have but very little loss; but otherwise, the larvæ, having no bees to feed them, will mostly starve. As soon as a few hundred bees are hatched, the queen will be found with them, and they will soon make a cluster; if the combs have been taken from strong colonies, where the queen is laying hundreds of eggs in a day, in a week or two the swarm will be a very fair one. Three frames will do very well at first, and one or two more may be added in the course of a week or more. Remember, *no live bee* is to be given to the queen. A queen is seldom lost by the first plan given, if you are careful, and watch them until they are safely received.

There is another way that I think has a little the preference. In order to describe it I can do no better than to make an extract

*They can be set out and allowed to fly in two or three days.

from an editorial in *Gleanings in Bee Culture*, page 539, Vol. XXI.:

We have just received a consignment of 30 imported Italian queens, direct from Italy, by express. Every queen came through alive and in good order, and they are now introduced into the apiary without the loss of one. Our method of introducing with this lot was something we had not tried before on so large a number of queens. We took four or five strong colonies, and divided them up into 30 one-frame nuclei. This was done in the forenoon. In the afternoon we transferred the imported queens, without any attendants, to the Miller introducing-cage. We then placed one of each in each one of the nuclei above mentioned; they were then left for two days. Most of the queens were out at the expiration of that time, in good order, and they are now all out.

You see, the point is here: These newly divided nuclei will have old and young bees, and more or less hatching brood. Before the imported queen is released, the *old* bees will have returned to the old stand, and it is these old fellows that always make trouble in introducing. By the time the queen is released, there is nothing but *young* bees, including those that were brought to the nuclei-stand and those that are hatched out in the interim. These, of course, all being young, will accept their new mother, without any trouble. The plan has proved to be so satisfactory that we shall employ it hereafter on all valuable queens.

HOW SOON SHOULD AN INTRODUCED QUEEN BEGIN TO LAY ?

As a general thing, we may expect her to begin laying next day; but sometimes, especially if the queen has been a long time prevented from laying, as in the case of an imported queen, she may not lay for three or four days, or even a week. If introduced in the fall of the year, she may not commence laying at all until spring, unless the colony is fed regularly every day for a week or more. This will always start a queen that is good for any thing.

INVERTING. See REVERSING.

ITALIAN BEES. At present the Italians are by far the most profitable bees we have; and even the hybrids have shown themselves so far ahead of the common bee that I think we may safely consider all discussions in the matter at an end. Many times we find colonies of hybrids that go ahead of the pure stock; but as a general thing (taking one season with another), the pure Italians, where they have not been enfeebled by choosing the light-colored bees to breed from, are ahead of any admixture. There has been a great tendency with bees, as well as other stock, to pay more attention to looks than to real intrinsic worth, such as honey-gathering, prolificness of the queens, hardiness, etc.; and I think this may have had much to do with the severe losses we have sustained in winters past.

Even if it were true, that hybrids produce as much honey as pure Italians, each bee-keeper would want at least one queen of absolute and known purity; for although a first cross might do very well, unless he had this one pure queen to furnish queen-cells he would soon have bees of all possible grades, from the faintest trace of Italian blood, all the way up. The objection to this course is, that these blacks, with about one band to show trace of Italian blood, are the wickedest bees to sting that can well be imagined, being very much more vindictive than either race in its purity; they also have a very disagreeable way of tumbling off the combs in a perfectly demoralized state whenever the hive is opened, except in the height of the honey-season, and of making a general uproar when they are compelled, by smoke, to be decent.

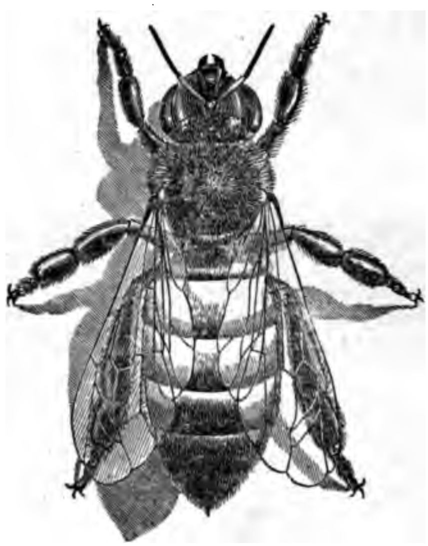
Our pure Italian stocks can be opened at any time and their queens removed, scarcely disturbing the cluster, and, as a general thing, without the use of any smoke at all, by one who is fully conversant with the habits of bees. A good many hybrids will not repel the moth, as do the half-bloods and the pure Italians. For these reasons and several others, I would rear all queens from one of known purity. If we do this, we may have almost if not quite the full benefit of the Italians as honey-gatherers, even though there are black bees all about us.

The queens, and drones from queens obtained direct from Italy, vary greatly in their markings, but the worker bee has one peculiarity that I have never found wanting; that is, the three yellow bands we have all heard so much about. Unfortunately, there has been a great amount of controversy about these yellow bands; and to help restore harmony, I have been to some expense for engravings.

Every worker-bee, whether common or Italian, has a body composed of six scales, or segments, one sliding into the other, telescope fashion. When the bee is full of honey these segments slide out, and the abdomen is elongated considerably beyond the tips of the wings, which are ordinarily about the length of the body. Sometimes we see bees swollen with dysentery spreading the rings to their fullest extent, and in that condition they sometimes would be called queens, by an inexperienced person.

On the contrary, in the fall of the year when the bee is preparing for its winter

nap, its abdomen is so much drawn up that it scarcely seems like the same insect. The engraving on the right shows the body of the bee detached from the abdomen, that we may get a full view of the bands or markings that distinguish the Italians from the common bees. Now I wish you to observe particularly, that all honey-bees, common as well as Italian, have four bands of bright-colored down, J, K, L, M, one on each of the four middle rings of the body, but none on the first, and none on the last. These bands of down are very bright on young bees, but may be so worn off as to be almost or entirely wanting on an old bee, especially on those that have been in the habit of robbing very much. This is the explanation of the glossy blackness of robbers often seen dodging about the hives. Perhaps squeezing through small crevices has thus worn off the down, or it may be that pushing through dense masses of bees has something to do with it; for we often see such shiny black bees in great numbers, in stocks that have been nearly suffocated by being confined to their hives, in shipping, or at other times. These bands of down differ in shades of color, many times, and this is the case with the common bee, as well as with the Italian.



HOW TO TELL HYBRIDS FROM PURE ITALIANS.

Under a common lens, the bands are simply fine soft hair, or fur, and it is this principally which gives the light-colored Italians their handsome appearance. You have, perhaps, all noticed the progeny of some particular queen when they first came out to play, and pronounced them the handsomest bees you ever saw; but a few months after they would be no better looking than the rest of your bees. This is simply because they had worn off their handsome plumage, in the " stern realities " of hard work in the fields. Occasionally you will find a queen whose bees have bands nearly white instead of yellow, and this is what has led to the so-called albino bees. When the plumage is gone, they are just like other Italians. Now, these bands of down have nothing to do with the yellow bands that are characteristic of the Italians; for, after this has worn off, the yellow bands are much plainer than before. A, B, C, are the yellow bands of which we have heard so much, and they are neither down, plumage, nor any thing of that sort, as you will see by taking a careful look at an Italian on the window. The scale, or horny substance of which the body is composed, is yellow, and almost transparent, not black and opaque, as are the rings of the common bee, or the lower rings of the same insect.

The first yellow band, A, is right down next the waist; now look carefully. It is very plain, when you once know what to look for, and no child need ever be mistaken about it.

At the lower edge is the first black band; this is often only a thin sharp streak of black.

The second, B, is the plainest of all the yellow bands, and can usually be seen in even the very poorest hybrids. The first band of down is seen where the black and yellow join, but it is so faint you will hardly notice it in some specimens.

We have at the lower edge of the scale, as before, a narrow line of black; when the down wears off, this shows nearly as broad as the yellow band.

When we come to hybrids, we shall find a greater diversity; for while the bees from one queen are all pretty uniformly marked with two bands, another's will be of all sorts; some beautifully marked Italians, some pure black, others one or two banded. Some will sting with great venom, while others with only one or two bands will be as peaceable as your best Italians. Without a doubt, many queens have been sent out as pure, that produced only hybrids; but since my recent studies in the matter, I am pretty well satisfied that I have sold several queens as hybrids that were really full-bloods. A very slight admixture of black blood will cause the band C to disappear on some of the bees,[130] but we should be very careful in such matters to be sure that the bees in question were really hatched in the hive; for bees of adjoining hives often mix to a considerable extent. If you examine a colony of blacks and one of hybrids that stand side by side, you will find many Italians among the blacks, and many blacks among the Italians. Take young bees that you are sure have hatched in the hive, and you will be pretty safe, but you can not readily distinguish the third band until they are several days old.

FOUR AND FIVE BANDED ITALIANS.

In 1890 and the following year there was quite a rage for four and five banded Italians. These are nothing more nor less than Italians bred for *bands* by selection. For instance, we may take a lot of black fowls, and from one having a few white feathers we may, by selection, breed fowls that are entirely white, at each generation selecting the whitest fowls to breed from. Some Italians show a tendency toward the fourth band. Perhaps some of the daughters of the mother of these bees will show in their bees a *greater* tendency toward the fourth band. Again, we breed from the last-named queen, and select from her another breeding queen whose bees show quite clearly the fourth band with a glimmering of the fifth. By continued selection we may be able to get the fifth. But after all, when we have bees with four and five yellow bands, we are liable to have bees for color and not for business.[129] It is possible to develop any trait that we may wish to have characteristic in our bees. In the same way it is possible to breed bees that are very energetic. But as a general rule we will have to lose sight of fancy colors.[505]

HOLY-LAND AND CYPRIAN BEES.

In 1882 considerable excitement arose over two new races of bees brought over from the Old World by D. A. Jones, of Beeton, Ontario, Canada, who was the leading bee-keeper across the line. They were called Cyprian and Holy-Land bees, from the places where he found them. The former, from the Isle of Cyprus, seem to have been for many years isolated, and are a very distinct and uniform race.

While they look like Italians, and might be classed as such by some bee-keepers not familiar with their peculiarities, yet they have some distinct characteristics. The Holy Land bees show whiter fuzz rings, and the bodies are slimmer than those of the ordinary Italians. They are more on the order of albinos. In fact, most of the albinos that were formerly sold were of Holy Land extraction. The Cyprians look very much like the four and five banded Italians. The yellow bands are of a deeper orange than those of the Italians, slightly wider, and some times more than three in number. Just at the base of the thorax, and between the wings, there is a little yellow spot that is quite distinct and prominent, and is called the "shield." This may be seen on some yellow Italians, but it is less pronounced.

When Italians are crossed with Cyprians or Holy Lands it is a little difficult to detect the difference except by their nervousness. And this brings me to the

TEMPERAMENT OF EASTERN BEES.

They are more nervous, especially the Cyprians. Some times smoke seems to have no power over them. They will fly up twenty or thirty at a time without warning, and sting the moment they touch the apiarist. The more smoke is used, the more enraged they become. Cyprians especially are the crossest bees ever brought into this country—so cross, indeed, there is scarcely a breeder in the United States who has them for sale. The same objection, though to a less extent, applies to the Holy Lands.

We once sold an imported Cyprian queen; and our customer, after he had kept her for a while, returned her, saying that her bees were so vicious that on one occasion they stung every thing in sight, and drove even the family down cellar. We bought the queen back; and after we had had her for a few weeks and her bees had begun to hatch

out we found it would hardly be safe to keep them in the yard. They would become so enraged at times that the whole colony of them would rush out in battle array. While the progeny of this queen was exceptionally cross, the general run, both of Cyprians and Holy Lands, was so disagreeable to handle that they are now well nigh discarded by the bee keepers of the United States.

The only possible redeeming feature is that they are good brood rearers; but they will breed to excess after the honey-flow, using up all their available stores in raising bees, when Italians would conserve their energies and leave enough honey for winter.

In the matter of rearing queen-cells, either the Cyprians or Holy Lands will rear more queens than any Italians, Carniolans, blacks, or hybrids we ever saw. We have known as many as a hundred cells on one frame; and we also had one instance where 25 cells from a Holy Land queen hatched within a few minutes of each other; and so vigorous were the young queens that some of them actually flew the moment they popped out of their inclosures.

ITALIANIZING. Few questions are asked oftener than, "How shall I Italianize? and when shall I do it?" There is always a loss in removing a queen and substituting another, even where we have laying queens on hand; and where we are to use the same colony for rearing a queen, there is a still greater loss. Under the heads of NUCLEI and QUEEN-REARING, these points will be found fully discussed. Where one has an apiary of black bees, his cheapest way, especially if he has plenty of time to devote to the subject, is to purchase a choice tested queen, and rear his own queens from her after the honey-flow. If he has as many as a dozen colonies, and proposes to continue to increase the number, it may be his best and surest way, to purchase a choice breeding queen. If she is bought in the spring or summer months, I would not remove the old queens until the summer crop of honey is over; but, instead of allowing natural swarming, take two or three frames from each old stock about swarming time, and make nuclei, giving them queen-cells from the Italian brood.

When these queens are hatched and laying, build the nuclei up, with frames of brood given one at a time, until they are full stocks. By such a course you have the full benefit of your old queens during the honey-season, until the new ones are ready to take their places. After the honey-yield has begun to cease you can remove the old queens, and give the now small colonies queen cells, as you did the nuclei at first. This does the swarming for the season, and the Italianizing, at one and the same time.

If you have more money than time to spare, and wish to have the work done up quickly, purchase as many queens as you have colonies, and introduce them at any season of the year, as directed in INTRODUCING QUEENS. You can purchase all tested queens if you wish, but I would advise taking the untested Italian queens during the months of July and August when they are the cheapest, and this is also the best time of the year to Italianize. If done in the spring it is liable through change of queens to cut off brood-rearing, and, hence, worker-bees when the harvest comes on. Some find it more convenient to change queens *during* the *swarming* season, first for the purpose of stopping swarming, and second because then there are plenty of cells usually at this time from choice stocks. See West's queen-cell protector under QUEEN-REARING.

After your stocks have all been provided with Italian queens, by either of the plans given above, if you wish your bees to be pure Italians you are to commence replacing all queens that prove to be hybrids, as soon as the young bees are hatched in sufficient numbers to enable you to decide. See ITALIAN BEES. Now, if honey only is your object, I would not replace these hybrids until they are one or two years old; for they will average nearly if not quite as well as honey-gatherers, and will raise just as pure drones as pure Italians. If you should find the bees of any particular queen too cross to be endurable, replace her with another, at any time. Be careful, however, that these hybrid colonies are not allowed to swarm naturally, for if they raise a queen she will produce hybrid drones*; and this is something we wish most scrupulously to guard against. It will be better to raise all the queens yourself, and make nuclei while you are seeking to Italianize, and more especially if you are surrounded with common bees.

*To get rid of black and hybrid drones, see DRONES.

L.

LAYING WORKERS. These queer inmates, or rather occasional inmates, of the hive, are worker - bees that lay eggs. Aye, and the eggs they lay hatch too; but they hatch only drones, and never worker-bees. The drones are rather smaller than the drones produced by a queen, but they are nevertheless drones, in every respect, so far as we can discover. It may be well to remark, that ordinary worker-bees are not neuters, as they are sometimes called: they are considered undeveloped females. Microscopic examination shows the undeveloped form of nearly every organ found in the queen, and these organs may become, at any time, sufficiently developed to allow the bee to lay eggs, but never to allow of fertilization by meeting the drone as the queen does. See QUEENS.

CAUSE OF LAYING WORKERS.

It has been over and over again suggested, that bees capable of this egg-laying duty are those reared in the vicinity of queen-cells, and that by some means they have received a small portion of the royal jelly, necessary to their development as bee-mothers. This theory has, I believe, been entirely disproven by many experiments; and it is now pretty generally conceded that laying workers may make their appearance in any colony or nucleus that has been for many days queenless, and without the means of rearing a queen. Not only may one bee take upon herself these duties, but there may be many of them; and wherever the bee-keeper has been so careless as to leave his bees destitute of either brood or queen for ten days or two weeks, he is liable to find evidences of their presence, in the shape of eggs scattered about promiscuously; sometimes one, but oftener half a dozen in a single cell. If the matter has been going on for some time, he will see now and then a drone larva, and sometimes two or three crowding each other in their single cell; sometimes they start queen-cells over this drone larva: the poor motherless orphans, seeming to feel that something is wrong, are disposed, like a drowning man, to catch at any straw.

HOW TO GET RID OF LAYING WORKERS.

I feel very much like saying again, that prevention is better than cure. If a colony, from any cause, becomes queenless, be sure it has unsealed brood of the proper age to raise a queen; and when this one is raised, be sure that she becomes fertile. It can never do any harm to give a queenless colony eggs and brood, and it may be the saving of it. But suppose you have been so careless as to allow a colony to become queenless, and get weak, what are you to do? If you attempt to give them a queen, and a fertile worker is present, she will be pretty sure to get stung; it is, in fact, often almost impossible to get them to accept even a queen-cell. The poor fellows get into a habit of accepting one of the egg-laying workers as a queen, and they will have none other until she is removed; yet you can not find her, for she is just like any other bee; you may get hold of her, possibly, by carefully noticing the way in which the other bees deport themselves toward her, or you may catch her in the act of egg - laying; but even this often fails, for there may be several such in the hive at once. You may give them a small strip of comb containing eggs and brood, but they will seldom start a good queen-cell, if they start any at all; for, in the majority of cases, a colony having laying workers seems perfectly demoralized, so far as getting them into regular work is concerned.

It is almost impossible to introduce a l y- ing queen to such colonies; for as soon as she is released from the cage she will be stung to death. No better results would follow from introducing a young virgin; but the giving of a queen-cell, if the colony has not been too long harboring laying workers, will very often bring about a change for the better. In such case the cell will be accepted, and in due course of time there will be a laying queen in place of the laying worker or workers; but often

cells will be destroyed as fast as they are given. The only thing then to be done is to scatter brood and bees among several other colonies, perhaps one or two frames in each. From each of these same colonies take a frame or two of brood with adhering bees, and put them into the laying-worker hive. The bees of this hive, which have been scattered into several hives, will for the most part return; but the laying worker or workers will remain and in all probability be destroyed. Of course, the colonies that have been robbed of good brood will suffer somewhat; but if it is after the honey season, no great harm will have been done. They will proceed to clean up the combs; and if they do not need the drones as they hatch out they will destroy them.

Sometimes a laying worker may be disposed of by moving the combs into an empty hive, placed at a little distance from the other; the bees will nearly all go into their old hive, but the queen, as she thinks herself to be, will remain on the combs. The returning bees will then accept a queen or queen-cell. After all is right the combs may be returned, and the laying worker will be—well, I do not know just what does become of her, but I suspect she either attends to her legitimate business, or gets killed.

See that every hive contains, at all times, during the spring and summer months at least, brood suitable for rearing a queen, and you will never see a laying worker.

HOW TO DETECT THE PRESENCE OF LAYING WORKERS.

If you do not find any queen, and see eggs scattered around promiscuously, some in drone and some in worker cells, some attached to the side of the cell, instead of the center of the bottom, where the queen lays them, several in one cell and none in the next, you may be pretty sure you have a laying worker. Still later, you will see the worker-brood capped with the high convex cappings, indicating clearly that the brood will never hatch out worker-bees. Finding two or more eggs in a cell is never conclusive, for the queen often deposits them in a feeble colony where there are not bees enough to cover the brood. The eggs deposited by a fertile queen are in regular order, as one would plant a field of corn; but those from laying workers, and usually from drone-laying queens, are irregularly scattered about.[515]

LOCALITY. This has a great influence in bee-keeping. Many of the manipulations recommended in one locality will not answer for another. A hive well adapted to one place might give indifferent results in another having different conditions. The length of the honey-flow, the time it comes on, whether the nectar comes in a rush for three or four weeks at a time as it does in the East, or whether the flow extends over a period of three or four months, coming in very slowly, are all conditions the bee-keeper must study and be able to meet as they are. A slow honey-flow, continuing over a period of four or five months, may require an altogether different hive. It may render the production of comb honey impracticable, for the reason the combs will be travel-stained, and therefore not fit to compete with honey from other localities. On the other hand, a short rapid honey-flow, as in the basswood regions, and where the honey is mainly white, and of good flavor, makes the production of comb honey more profitable than extracted as a rule. Then locality, too, has a bearing on the kind of treatment the bees should receive. If there is no honey after the first or middle of July, and the bee-keeper is located in a region where snow falls in winter, and where cold winter weather prevails for five or six months, he will have to make his plans to keep down brood-rearing after the honey-flow, and arrange to get the bees in the best possible condition for cold weather. He will probably have to feed, and then in the spring he will be compelled to stimulate brood-rearing to a high pitch as soon as the bees can fly, thus getting the colonies strong at the beginning of the honey-flow. If, however, one is located in the South he must see that his bees have a large amount of stores; for in a warm climate they will consume more than in the North, where it is cold. While the bee-keeper of the colder regions tries to prevent his bees from dying during the winter, he who is located in the South endeavors to prevent his bees from starving until the next honey-flow shall come.

THE BEST STATES FOR KEEPING BEES.

We are very often asked the question as to the best location in the United States for keeping bees as a business. We usually advise the inquirer to stay right where he is. While bee-keeping in good seasons may be very profitable in California, yet experience has shown that the honey-producers of the Golden State have only one good year in about three or five. Taking every thing into consideration they do not average any

better than their brethren of the East, where the market is certainly better. Colorado, Arizona, New Mexico, Utah, Idaho, *in the irrigated portions*, sometimes show wonderful results in honey; but in all the States named, where the bee-range is at all good, the country is overstocked with bees and bee-keepers, and one can scarcely get into one of the places without buying out somebody already in the field.

Texas as an all-around bee country is one of the best bee States in the Union. It is not over-populated yet, and there are very many desirable bee-ranges within its borders. The same may be said of Idaho and Utah. Kansas and Nebraska are good bee States, having usually good fall flows; but sometimes either or both have fearful drouths that kill down nearly all vegetation, rendering farming as well as bee-keeping, for that season, almost a failure. Among the eastern States, New York is one of the best because it has, in addition to clover and basswood, immense acreages of buckwheat, which on these hills yields immense quantities of honey. Wisconsin and Minnesota were formerly good localities for basswood; but that desirable tree for timber as well as honey is now being rapidly cut off, and the main stay will be, as with the other States, white clover, with a large sprinkling of sweet clover along the roadsides and railways. Most of the north-central States have conditions that are practically the same, reaching away from Minnesota to Maine, and continuing down the Ohio River and Chesapeake Bay. While the amount of honey secured in these localities is less per colony, the price secured is higher, because in this portion of the United States the centers of population are located. Throughout the South, east of the Mississippi, the honey secured is very good, mostly extracted, and the flow covers a long period; but the quality is not quite equal to the honey of the North.

LOCUST. This tree is so well known as scarcely to need a description. It grows very rapidly, and bears blossoms at a very early age; and could we be assured of having every year the crop of honey that the locust bears (perhaps one year in five), I should at once plant a locust-grove exclusively for honey. It blossoms profusely almost every season; but the bees often pay no attention at all to the flowers.

The honey comes at a time when it is very much needed, as it is a little later than the fruit-bloom, and a little earlier than white clover. If any thing could be done by a selection of different varieties, or by cultivation, to make it bear honey every season, a locust-grove would be a very valuable addition to the honey-farm.

The leaf of the locust much resembles the leaf of the clover, only it has a great number of leaves on a stem instead of only three; the blossom is much like that of the common pea, both in appearance and size. It is an interesting fact, that the locust, pea, and clover, all belong to the same order, *Leguminosæ*.

LUCERNE. See ALFALFA.

R. B. FRAY'S APIARY AND PORTABLE HONEY-HOUSE, CALIFORNIA.

M.

MANIPULATING FRAMES. See FRAMES, HOW TO MANIPULATE; also REVERSING.

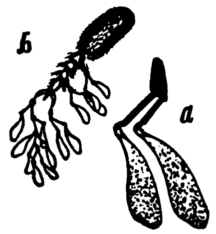
MARIGOLD (*Gailardia pulchella*). This is found all over the United States, but so far as I know it does not yield any great amount of honey except in Texas, where it is considered one of the main honey-producing plants. It begins to yield in May or June, giving a rich golden honey. While it is praised greatly by many connoisseurs in the South, it would not rank well with clover and basswood in the North. The comb honey is of a golden yellow, and not white.

MESQUITE. This is a very important honey-plant or tree of Texas or Arizona. It grows in almost desert lands, and is essentially a dry-weather tree. It yields immense quantities of light-amber honey of medium quality; but some of our friends in Texas regard it as something very fine; but in the Northern markets it would rank as an amber and of second quality.

There are thousands and thousands of acres of it growing wild on land that will grow nothing but catclaw and guajilla. It grows at its best in Uvalde County, Texas, the trees sometimes being as much as two feet in diameter; but those I saw were about as large as one's arm. The illustration shown on next page shows it as I saw it at its best.

MILKWEED (*Asclepias Cornuti*). This plant is celebrated, not for the honey it produces, although it doubtless furnishes a good supply, but for its queer, winged masses of pollen which attach themselves to the bee's feet, and cause it to become a cripple, if not to lose its life. Every fall we have many inquiries from new subscribers in regard to this queer phenomenon. Some think it a parasite, others a protuberance growing on the bee's foot, and others a winged insect-enemy of the bee. We give above an engraving of the curiosity, magnified at *a*; and also of a mass of them attached to the foot of a bee.

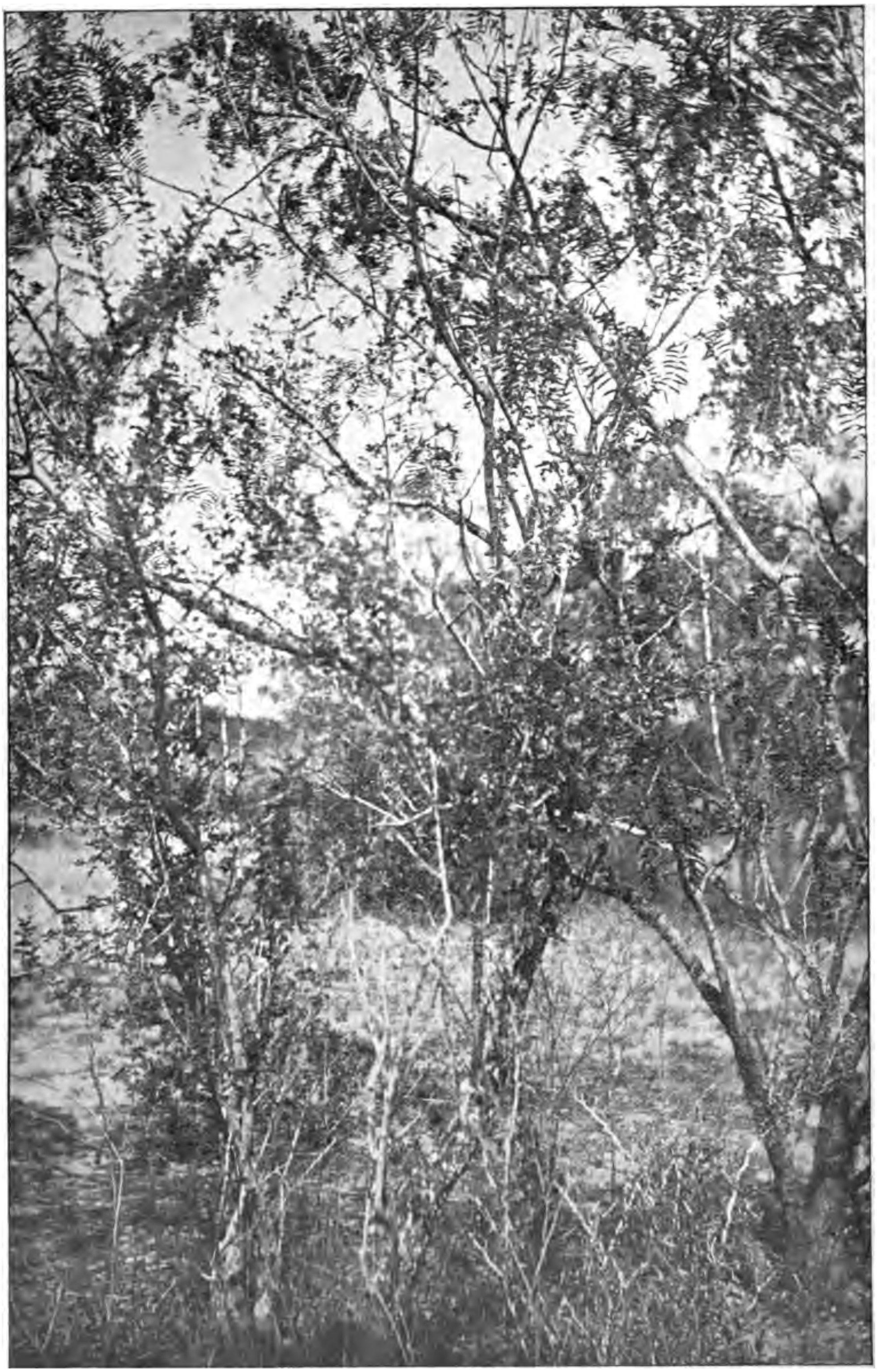
It is the same that Prof. Riley alluded to when he recommended that the milkweed be planted to kill off the bees when they become troublesome to the fruit-grower. The



POLLEN OF THE MILKWEED, ATTACHED TO A BEE'S FOOT.

folly of such advice—think of the labor and expense of starting a plantation of useless weeds just to entrap honey-bees—becomes more apparent when we learn that it is perhaps only the old and enfeebled bees that are unable to free themselves from these appendages, and hence the milkweed can scarcely be called an enemy. The appendage, it will be observed, looks like a pair of wings, and they attach themselves to the bee by a glutinous matter which quickly hardens, so that it is quite difficult to remove, if not done when it is first attached.

MOVING BEES. Bees fly from their hives in quest of stores, perhaps a mile; sometimes a mile and a half or two miles; but they will seldom go beyond these limits, unless at a time of great scarcity of pasturage.[141] Well, after a bee has once fixed its locality, it starts out in the morning on a run, and never stops to take the points, as it does the first time it sallies out from a new locality. The consequence is, if we have moved its hive, either in the night or day time, and have not moved it more than a mile, it will, when it goes back, strike directly for its old locality. On reaching there and finding its hive gone, it is lost and helpless; and, even though the hive may be but a few rods away, it will never find it in the world. New hands frequently move



MESQUITE-TREE, UVALDE, TEXAS.

their hives close together at the approach of winter, that they may better protect them with chaff or straw. I do not know how many times mishaps resulting from this kind of proceeding have been related to me. All goes very well, perhaps, until we have a warm day; then the bees start out for a fly, and very naturally return to their home just as they have been doing all summer. If no one is near to restore their hive to its former location, they fly helplessly around for a while, and then alight on the trees and fences, scattered about, and finally perish. If other hives are near they will get into the wrong hives and get stung; or if their numbers are great enough they will sting the queen, because she is a stranger to them. Sometimes the bees of the whole apiary will become so mixed up that they have a general melee and fight, resulting in great damage, if not in the destruction, of many of the colonies. Moving hives short distances during the working season is almost always done with loss of more or less bees, and consequently honey.

It is true, bees may sometimes be moved without loss, for there is quite a difference in the disposition of colonies; and where one may be moved all about the yard without any apparent loss, the next may suffer if moved only a few feet. I once purchased a very strong colony of blacks of a neighbor, and, to be on the safe side, moved them on a cold day in December. I think it was a week afterward when it became warm, and the bees went back to their old home in such numbers that the first cold night froze out the remaining ones, and I lost my stock entirely.[142] At another time, a neighbor wished me to take a swarm from a very strong stock of blacks. As I had but little time I set another hive in its place, containing a frame of brood and a queen-cell, and moved the old one several rods away. He told me next day that the bees had all found their old home, and deserted the brood-comb entirely. I directed him to move it again, and place it the other side of the orchard; but it seems these wily blacks had learned the trick, for they all found it even there. Italians, as a general thing, are more ready to take up with a new location than the blacks, and stick more tenaciously to their home and brood.

Sometimes, shaking the bees all in front of the hive, and letting them run in just like a natural swarm, will answer to make them stick to their new locality; at other times, moving the hive away for an hour or two, until they get really frightened at the loss of their home, will have the same effect, after it is once brought back to them. In this case they seem so glad to get their dear old home again that they will adhere to it wherever it is placed. Neither of these plans can be relied on implicitly, and I really do not know of any that can.* Sometimes we succeed by leaving a comb for the returning bees to cluster on, and then take them to the new stand just at nightfall. When allowed to run in, they exhibit their joy by loud notes of approval, but, just as likely as not, they will be back at the old spot the next day, just the same. With patience, we can by this means save most of them. As a natural swarm will stay wherever they are put, any thing that reduces a colony to the condition of a natural swarm will accomplish our object. Bees depend very much on the surrounding objects, in taking their points; and I have known a whole apiary to be successfully moved a short distance, by moving all the hives and preserving their respective positions with reference to each other. Carrying bees into the cellar for several days or a week will usually wean them from their location, so that they may then be located anywhere; but this plan is objectionable on account of the labor it involves. Where we wish to divide a colony the matter is very easy, for we can carry our stock where we wish, and start a nucleus of the returning bees. The usual way, and by far the easiest where it can be done, is to wait until winter, and move them after they have been confined to the hive for several weeks by cold weather. Bees moved in the spring seldom go back to their old quarters, for they generally mark their location when they take their first flight, whether they have been moved or not. Bees can also be moved short distances, in warm weather, by taking them a mile or more, leaving them a couple of weeks, and then bringing them back to the spot where you wish them to remain. This plan would be too much trouble and expense to be practicable generally.

Here is another plan, taken from *Gleanings in Bee Culture*, that is worthy of consideration, although I have never tried it. It is as follows:

MOVING A WHOLE APIARY A SHORT DISTANCE; A NEW PLAN.

I believe it is generally understood among bee-keepers that it is quite impossible to move bees when they are working, without considerable loss. I moved my apiary the last of May, about half a mile, without the

* Placing a board, or other object, over the entrance so as to hinder the bees a little as they come out, is sometimes practiced to make them return.

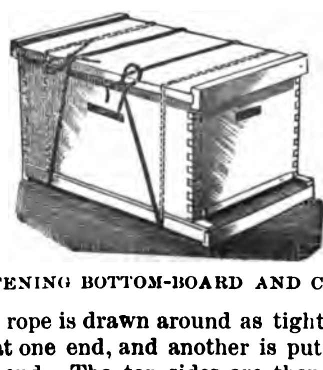
loss of any. This is the way I accomplished it: In the day time I prepared my hives by tacking cleats across the bottom-boards and bodies, and also covers. I removed the oilcloth so the bees could cluster up in the cover (my covers have a three-inch air-space, ventilated). At night I stopped the entrances and put them on the wagon, the box having plenty of straw in the bottom, with boards on top of the straw for hives to stand on. Then I hauled them over and put them down anywhere, and left them until next day, with entrances still closed. I left in the old yard two hives, one at either side of the yard, each with a little brood, and a few bees and plenty of combs. Next day I went over and arranged the hives in the places I wished them; then about eleven o'clock went to each hive, thumped it, began removing obstruction at entrance, smoking bees at the same time. I went home to dinner and found a few bees coming back, but not nearly as many as I expected, and they were fast finding the two hives that I had left. I let those two hives stay until the next night, then took them to the cellar and left them two nights and a day; took them to the new yard early in the morning; placed one hive in its proper position, took the combs out that had the bees on, and placed the combs with bees from the other hive in their place. I then closed the hive and went to the old yard to watch for bees. I do not think there were a dozen bees lost in the whole operation. C. H. PIERCE.

Kilbourne, Wis.

MOVING BEES TO AND FROM OUT-APIARIES, ETC.

If you wish to move bees during the daytime, while many are in the fields, you can get them nearly all in by smoking them at intervals for about half an hour. This will give those that are out time to come in, and the smoking will prevent any more going out. If the colony is a very strong one, leave á hive with a comb of brood on the old stand, and the owner can start a nucleus very conveniently with the returning bees.

Most bee-keepers fasten the bottoms to their hives permanently, so all that is necessary in such cases is to secure the cover and put a wire-cloth screen over the entrance. A very good plan is shown in the next engraving, consisting of two cords or ropes.

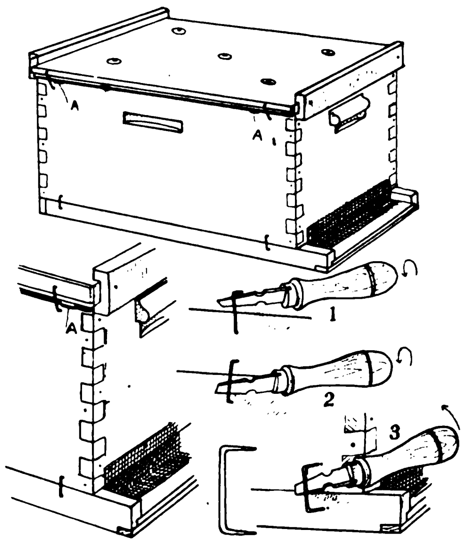


FASTENING BOTTOM-BOARD AND COVER.

One rope is drawn around as tight as possible at one end, and another is put on the other end. The top sides are then drawn together in such a way as to produce a strong tension.

Another plan, something similar, is to use one cord or one rope, rather. It is drawn around the hive, and tied loosely. A stick is then slipped into the cord and given a half-twist in such a way as to draw the loop up very tight.

But by far the most satisfactory plan, certainly the safest, and the one that we adopt in our own moving, is that of using a special staple (obtained at the hive-factories) as shown in the accompanying illustrations.



One leg of the staple is driven into the bottom-board, and the other into the hive-body. One staple on each side and one in the rear will be sufficient to hold the bottom-board.* For the cover there should be four staples—two in each side. The staples are very easily removed, with a screwdriver at least a foot long if they are not driven down too tight. The tool is shoved under one side, close to one leg of the staple, and given a quarter-twist, and then it is moved over to the other side, and twisted again. When the staple is raised high enough so the screwdriver can get under it and give it a good pry it can be easily removed.

HOW TO PREVENT THE BEES FROM SMOTHERING.

Provision should be made to prevent the bees from smothering. Even in the hottest weather we do not now use wire-cloth screen

* All our bottom-boards are permanently fastened in this way, and when necessary the staples can be removed without turning the hive upside down to remove the nails.

on top. Four pieces of wood about ⅜ inch wide, and not more than ⅛ inch in thickness, are put between the cover and the hive at the four corners. The staples are then driven in. This leaves a gap of ⅛ inch between the hive and cover. This, together with the entrance-screen, usually affords sufficient ventilation providing one does not have to be too long on the road. But even in that case one can prevent smothering the bees by dashing a pint of water over the entrance-screen. This will drive the bees from the wire cloth when smoke would not. Smoke, on the other hand, would only tend to aggravate the trouble, whereas the water affords instant relief. It cools the bees and drives back those that are shutting off ventilation.

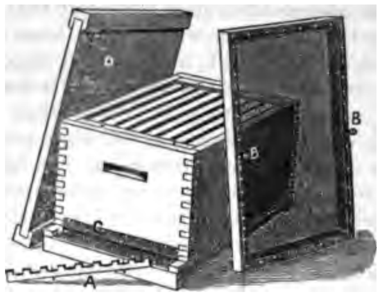
If the water does not succeed in keeping the bees from the wire cloth, remove the screen and let them come out. If the hives have been at least half a mile on the journey there is very little fear of the bees flying out after they have been jarred on the road.

A LOAD OF BEES TO OUR OUT-APIARY.

Our wagon, a platform spring, will hold 45 empty hives; and on smooth roads we carry that number of hives containing colonies. Ordinarily 30 to 35 make a good load, because we seldom have roads in such perfect condition that we dare risk such a weight. The box of the wagon will take 12 hives, and the raised platform will carry the remainder. The hives will probably stay in their place; but to prevent accident they are secured with ropes, as shown in the cut. The driver sits in the middle of the load, so that he can watch for and prevent any unexpected developments.

SHIPPING BEES LONG DISTANCES BY EXPRESS.

During hot weather great care should be exercised that the bees be not smothered, nor their combs melted down by the intense heat that is generated where they have an insufficient quantity of air during shipment. After a large experience, and many mishaps in shipping bees in the summer time, we have now decided on covering both the top and bottom of the hive with wire cloth. For short distances, and more moderate weather in summer, a piece of wire cloth

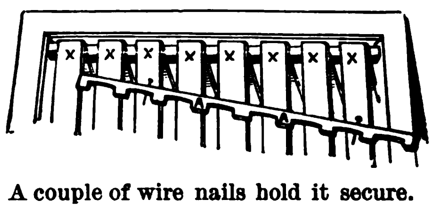


THE DOVETAILED HIVE, PREPARED FOR SHIPPING BEES.

tacked over the entrance, and a single wire-cloth cover, will answer; but the entrance itself should not be closed, for it affords a draft that passes up through the cluster, to the wire cloth above. The preceding cut illustrates the method we have used for shipping bees with success with the Dovetailed hive, described elsewhere.

A couple of screws, B B, fasten the wire screen to the hive. The bottom is similarly secured. To move the screen, no prying nor pounding is necessary. Simply loosen the screws, and the screen will lift off without a jar.

To secure the frames so that they will not shuck about, we use a notched stick, as shown in A A, of the accompanying cut, the notches passing down between the frames just over the rabbet in the hive.



A couple of wire nails hold it secure. A similar notched stick is nailed to the bottom-board, notches upward, transversely through the center. This keeps the bottoms of the frames from jarring against each other. After the wire cloth has been tacked to the entrance, the combs put in the hive, and secured by the notched sticks, the wire screen screwed down, the whole arrangement is ready for shipment.

Of course, if your bees are on fixed frames

—that is, either the Hoffman or the closed-end, referred to and described under FRAMES, MANIPULATING; FIXED FRAMES, and under HIVE-MAKING, no notched spacing-strips will be necessary. The frames are already fastened for moving or shipping; and the beauty of it is, no time need be lost in preparing them for that purpose.

It is almost absolutely necessary that the combs themselves be wired, or at least that they be old and tough, and securely attached to the bottom-bar if not wired. It is always risky, however, to ship in combs when not wired.[144] It is impossible to tell what sort of rough usage they will receive at the hands of careless or indifferent express agents: and while we should not be too hasty in condemning railroad officials for careless handling, we should take every precaution. The bees buzzing around the wire cloth is usually enough to guarantee safe handling; but as many do not know how to handle and take care of bees, we are in the habit of printing in large letters, in red, on a piece of cardboard, as follows:

KILLED!

This Hive contains Live Bees, and they will be "Killed" if roughly handled, or left in the Sun, or not kept This Side Up. Will you please be careful of the little fellows?

This card is tacked on one corner of the wire-cloth screen. Of course, the word "killed" is to command attention; and there are very few railroad officials who will not heed the instructions. Bees should always be sent by express. Although I have sent them safely by freight as far as Massachusetts, I would by no means recommend it.

If bees are to be sent long distances, be sure that they have plenty of stores, for the excitement attendant upon confinement and jolting about sometimes causes them to consume honey enormously.

HOW TO PREPARE A CARLOAD OF BEES.

If you use loose, hanging frames, fix them with the spacing-strips illustrated on a previous page. If your frames are of the fixed type, of course no spacing-device will be necessary. Remove the cover, and cover the top of the hive with wire cloth. The best way will be to make a two-inch rim and nail the wire cloth on top of this, as explained on a previous page. There should be about two inches between the brood-frames and the wire cloth. Before loading them in the car, strew about four or five inches of loose straw on the car floor and then place your colonies upon this, four or five inches apart. After the car bottom is covered put some 2 x 4 pieces across the tops of the hives, and then your next tier of hives on top of these. For convenience in loading, leave a passageway through the center of the car, and then, if you accompany your bees, you can easily get at any of the colonies. The purpose of the straw is to give a spring to soften the heavy concussions. One thing more that is important: Be sure to load the hives so that the frames are parallel with the rails; and, don't pile them up more than two or three tiers high. In loading on the wagon, put the frames so that they are parallel with the axletree.

CAUTION.

Before closing, let me add a caution. In moving bees, be sure that you have fixed all the entrances so that not a bee can by any possibility escape. Do not have your wire cloth too short, and then splice it out with leaves. Be sure to have it cut exactly the right length. For further particulars, see OUT-APIARIES.

MUSTARD (*Sinapis arvensis*). This belongs to the same family as the turnip, cabbage, rape, etc., all of which, I believe, almost invariably furnish honey while they are in bloom. We have a good opportunity of testing these plants, because acres of them are raised for other purposes besides the honey. It will be a hard matter to determine which is best for your locality, without trying some of each. Find out what kind of a market you have for your seed, and then proceed to raise it as if you were going to depend on the seed alone to pay expenses. Should you secure a good crop of honey from it, you will then be so much ahead, and there is little chance of any great loss.

The honey from these plants is said to be very light, equal to any in flavor, and to command the highest price in the market. The seed should be sown very early in the spring, either in shallow drills so far apart that the cultivator can be used between them, or broadcast. The former plan is, of course, the better one for nearly all honey-plants, but is more trouble. From 6 to 10 lbs. per acre will be needed, if sown in drills, and from 15 to 20 if sown broadcast. If you wish to save the seed, it should be sown not later than July 1st. When the greater part of the pods are ripe, the stalks are to be cut and carefully dried. A cloth should be spread in the bottom of the wagon, when gathering, for the seed will shell out consid-

erably, if it is in proper condition to thrash. I presume we have machines especially adapted for cleaning and thrashing the seed, but I have always seen a flail and fanning-mill used. Of course, it should be thrashed on a tight floor, or on a floor made tight by a large piece of canvas. The seed of the common kinds of mustard brings $1.15 per hundred pounds. I do not know how many bushels are raised per acre. The Chinese variety has been highly extolled for bees; but we have found the common black mustard that grows almost of itself to thrive better, and be more visited by the bees. Who will give us the results of some practical experiments?

MENDLESON'S MOVING-RACK FOR HAULING A WHOLE APIARY. (CALIFORNIA.)

Floor space, 7x19½ feet.; slats 4 ft. high; carries each tier 50 colonies, or 100 double-story colonies. There have been 150 single-story colonies on it at one time. Capacity of springs, 5 tons. Estimated weight of the rack, 1000 lbs. The rack will fit any 44-inch bolster of lumber wagon. A set of broad steps slide in under for loading. Bed-pieces, 3x8x20; cross-pieces, 3x4; side-pieces for stake-irons, 3x4x20; stakes, 2x3x4½; slats, 1x2, all riveted seat standards, 2x6, thoroughly bolted, and very firm; made at the apiary, spring of 1895.

N.

NUCLEUS. This word, applied to bee culture, signifies a small colony of bees, perhaps from one-fourth to one-tenth of a full colony. The plural of the word is nuclei; it were well to bear this in mind, for there is much confusion in the use of the terms, even in printed circulars. If you remove a dozen bees from the hive, take them so far away that they are homeless, and then let them fly, they will after a time come pretty nearly back to the place from which you released them; but unless they have a queen with them they will soon wander away and be lost. If you give them a queen they will come back to where they left her, and will probably remain if *she* does not stray away. She, like the rest, must fulfill her destiny, or she will wander away; we shall therefore have to provide her a comb wherein to lay eggs. The bees would build the comb themselves, if there were enough of them, and they had plenty of food. A dozen would never build any comb; neither would they make any attempt to rear and hatch her eggs, if the comb were given them. Perhaps a hundred bees put in a suitably small box, with a fertile queen, might start a colony, and this is what we call a nucleus.[145] It is the center, about which a colony of bees may in time be formed. If they should be built up to a full colony, the building-up would be done by the queen's filling her combs with eggs, which, when cared for by the nursing bees (see BEES), would be converted into larvæ, and in 21 days would be hatched into perfect bees. These bees would then help the original hundred, and the queen would fill a still larger area with eggs, which would be hatched in the same way, and so on. The difficulty in the way of building up from such small beginnings seems to be that the queen will lay all the eggs a hundred bees can care for, perhaps in an hour or two, and then she has to sit or loaf around for the whole 21 days, until she can have another "job." Before the 21 days are up, she will be very likely to get disgusted with such small proceedings, and swarm out, or at least induce the bees with her to do so. See ABSCONDING SWARMS. If we should increase the number of bees to 500 or 1000, we should get along very much better, and there should be little danger of swarming out, unless the hive given them were too small. A very spry and ambitious queen might fill all the cells the bees had prepared for her, then set about filling them the second time, as they sometimes do, and then swarm out; but with a quart of bees—about 3200, if I have figured rightly—things will generally go along pretty well.

If we are to have this quart of bees work to the best advantage, something depends upon the sort of hive they are domiciled in. A single comb, long and narrow, so as to string the bees out in one thin cluster, is very bad economy. Two combs would do very much better, but three would be a great deal better still. It is like scattering the firebrands widely apart; one alone will soon go out; two placed side by side will burn very well; and three will make quite a fire. It is on this account that I would have a nucleus of three, instead of one or two frames. The bees seem to seek naturally a space between two combs; and the queen seldom goes to the outside comb of a hive, unless she is obliged to for want of room.

FORMING NUCLEI FOR INCREASE; HOW TO DO IT.

Dividing colonies into nuclei for the sake of increasing the number of hives with bees in, is usually very bad practice, especially in the hands of beginners. When one is running for honey, colonies can not be much too strong. But there are times, especially after a severe winter, and many of the colonies have died, when some form of artificial increase is desirable. There are several plans; but here is one I have practiced with success. We will start with one colony.

As soon as there comes settled warm weather I would divide my colony up into four two-frame nuclei. To each I would

introduce an untested Italian queen at the time of making the division; contract the entrances down to each hive, so that one or two bees can pass at a time. I would then feed a little every day. If I could just as well I would use cushions on top of the frames, and on each side, putting the nucleus in the center of the hive, as it is very important to keep the little cluster of bees warm.

When the queen fills the frame or frames with eggs, and there are bees enough to cover, I would put in another frame on the *outside*. As the weather warms up it might be advisable to put in still another frame, putting this one in the *center* of the cluster, in the mean time keeping up gentle feeding daily. A very good feeder for this purpose is the Boardman. See FEEDERS. This can be slipped into the entrance, and by screwing the can tightly or loosely into the cap the flow of feed can be regulated for the daily needs.

I would make the syrup by mixing together sugar and water in equal proportions by measure. Stir thoroughly, and then pour into feeder-cans.

As soon as the nuclei have four or five frames of sealed brood, larvæ, and eggs, take out one or more frames from each, and form another. This plan can be continued till one has 15 and possibly 20 little colonies; but he should stop dividing within at least 60 days before the setting in of cold frosty nights.

If one can not afford to buy queens he will have to raise them and then the increase will be cut down more than a half, probably.

In 1892 I myself, without any special effort, reared all the queens, and increased an apiary from 10 colonies, some of which were almost nuclei, to some 85 good colonies that went into winter quarters. They had no empty combs, but they were given full sheets of foundation. They were not fed, but were made to depend entirely on natural sources for their supply. Had I fed after the honey season, and given empty combs, I might have made double the increase.

But there is one objection to the plan above named; and that is, some of the bees will return to the parent colony. To partly remedy this I have put most of the bees into the hives on the new stands, leaving very few in the old *stand*. This will soon have more bees from the other hives.

Another method, first introduced to the bee-keeping world by Mr. W. W. Somerford, is reported to give such good results that I am glad to place the plan before the readers of this work.

To begin with, remove the queens or cage them in all your fancy stock. After getting the brood-nest well filled with brood (the more brood the better—8 or 10 frames in a hive if possible) wait ten days after removing the queen, when the bees will generally have cells on each and every comb, and be in a broody or listless condition, waiting for cells to hatch. Divide and remove the frames quietly, giving each new hive two frames of brood and all adhering bees, and one good frame of honey, using it for a division-board (and, by the way, such division-boards are to my notion the best in the world); put the two frames of brood and bees next to the wall of the hive, and let the honey-frame be the third from the side of hive. Be sure to see that you have at least one good ripe-looking cell in each new hive, or division, and don't forget the frame of honey. As soon as each division is made, stop the entrance of the hive by stuffing it full of green moss. If you haven't any green moss, use green grass or leaves, and be sure to stuff them in tight—as tight as though you never intended the bees should gnaw out, and be sure there are no cracks or holes that a single bee could get out at; for if there are, your division will be ruined by all, or nearly all, the bees that can fly leaving it. Each parent colony should make four or five good divisions that will make booming colonies in 40 or 50 days, and I have had them the best in the apiary in less time. Leave or loose the old queen on the old stand (if not too old), and the bees from it will work straight ahead, as they don't have to be confined to make them stay at home.

Don't be uneasy about the divisions that are stopped up, unless you failed to stuff the entrances well, for they *will not* smother, but busy themselves with gnawing at the moss or grass for two or three days possibly four or five, if you have done an extra good job at stuffing the entrance. At the end of that time you will find them all gnawed out so as to have egress and ingress. Then you can move enough of the grass or moss to give them a clean entrance, 1½ or 2 inches wide; and by looking into them you will be astonished at the quantity of bees you have in each hive (and they too, well satisfied), having consumed so much time in gnawing out that the queen had time to hatch and kill off her rivals and be ready for the wedding-trip by the time the entrance is cleared. So, instead of in a week's time, having a worthless weak division with a *chilled* inferior queen, as is the case in the old-style way of dividing, where nine-tenths of the bees return to the old hive, you have a strong vigorous queen and a nice little *satisfied* swarm of bees, ready for business in the way of pulling foundation before they are three weeks old.

I have succeeded with nineteen out of twenty divisions made in the above way, when I did not even see them until the third week, after dividing them as above. And for the average bee-keeper who has out-apiaries I think there is no better way in the world to make increase. If there is I'd like to see or hear of it while the expansion question is being expanded.

In the above method of increasing, you have no queens to buy, no robbers to bother with, and but little time lost, as an expert can make 20 divisions an hour.

Navasota, Tex.

O.

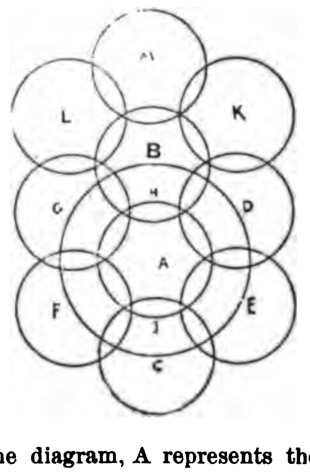
OUT-APIARIES.—Within late years this term has been used to apply to bee-yards remote or distant from the home yard by some two or three miles. It is a well-known fact, that only a limited number of colonies, comparatively, can be accommodated in any one locality, different localities being able to support a wide difference in the number of colonies.

NUMBER OF COLONIES IN AN APIARY.

The number of colonies of bees that can be profitably kept in one locality is limited by the amount of pasturage. Of late years quite a number of bee-keepers have established one or more out-apiaries, for the sake of keeping more bees than the home pasturage would support. Just how many bees can be supported in a single locality has probably never been ascertained, and it is just as probable that it never will. One field may support five times as many as another, and the same field may support five times as many this year as last. Most bee-keepers, however, think it not advisable to keep more than 75 to 100 in one apiary, whilst a few think their locations so good that 200 or more can be profitably kept together. The man who has only a few more colonies than he thinks best to keep in one apiary may find it better to have his bees *just a little* crowded at home before he goes to the extra expense of an out-apiary. Indeed, it depends somewhat upon the man, whether, having been successful with one apiary, he will find any profit in the second. But having gone so far as to have one or more apiaries away from home, it is not best for him to have any crowding in the least. If 100 colonies will do well in each apiary, the probability is that 75 will do better; and while there is unoccupied territory all about him he would better keep on the safe side and have so few in each place as to feel sure of no overstocking. His own convenience would have much to do in deciding. For instance, if he has, in all, 300 colonies, and thinks that 100 can find enough to do in a place, but can get through the work of only 75 in a day, then he will keep the 300 in 4 apiaries of 75 each, rather than in 3 apiaries of 100 each. For it will make him less travel to have in each apiary just what he will do in a day's work. If he can do 50 in a day, then he may just as well have 100 in two apiaries as in one, for in either case he must make two trips to get through with them.

DISTANCE BETWEEN APIARIES, AND LOCATION THEREOF.

A location for an out-apiary must, of course, be far enough distant from the home apiary not to interfere much; but just how far is best, it is not easy to decide. Perhaps, all things considered, a good distance is something like three miles apart. As the area of flight is a circle, the ideal plan of locating out-apiaries so as to fully occupy all adjoining territory is to put them in hexagonal form, in which case a circle of six will surround the home apiary.



In the diagram, A represents the home apiary, and B, C, D, E, F, G, the out-apiaries, at equal distances from A and from each other. If more than seven are needed then a second series may be started, as at

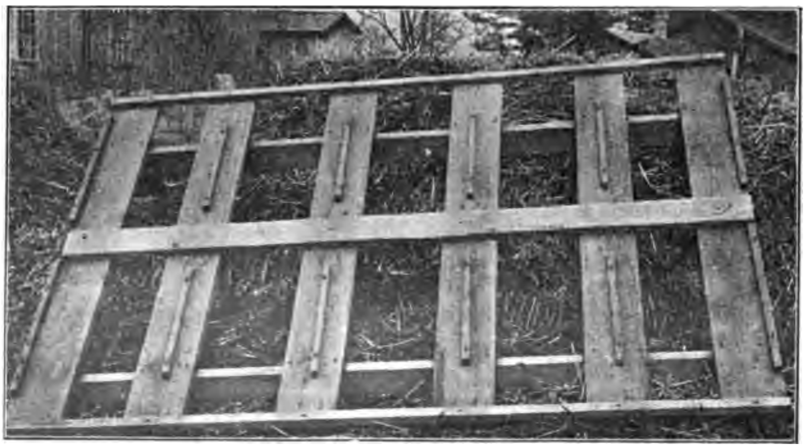
K, M, L, indicated by the letters. The circles representing the area of flight from each apiary are seen to overlap each other; but this is at the outer parts, where the ground is more sparsely occupied, and the doubling on the same ground is compensated by the convenience of the shorter distance to go from one apiary to another. But this ideal plan, although a good thing to work from as a basis, is not likely ever to be fully carried out. Many reasons will make it desirable to vary. The roads may run in such directions as to make a difference; no g od place may be found for an apiary at some of the points, etc. It may be remarked, that the area of flight is not always a circle. An apiary placed in a valley between two ranges of hills might have an oblong area, the bees perhaps flying twice as far along the line of the valley as in the other direction. If only a single out-apiary is to be planted, it is probably best to go in the direction of the best pasturage—a thing not always easy to determine. Sometimes one location proves to be better than another, year after year, although no apparent reason for it can be seen. It may even be worth while to vary a location a mile or more for the sake of having it where pleasant people live. But you can do much toward making the people pleasant by being pleasant yourself. See to it that you make as little trouble as possible, and be still more careful than at home to avoid every thing that may incite robbing, for robbing begets cross bees on the place.

RENT FOR OUT-APIARIES.

The agreement between the bee-keeper and his landlord, for rent, is as varied as the cases that occur. Some pay a fixed sum, five or ten dollars per year; some agree to pay a per cent of the crop; some make a bargain to pay so much for every swarm hived by some one of the landlord's family, and so on, while some can not get the landlord to agree to take any rent whatever. In this latter case it is only right to make sure that the landlord has a good supply of honey for his family to use during the coming year. In any case, make sure to do *a little better* than is expected of you.

HAULING BEES.

Whenever you decide to start a second apiary, you must give some attention to the matter of hauling. If you winter on summer stands, there will be less hauling than if you bring all your bees home to winter in the cellar and then take them back again in the spring. If you use chaff hives you can have light cases made to carry merely the brood-frames with the bees. The first thing to see to is to make *very sure* that no bees can get out to sting the horse or horses. Of course, you think you are careful, and that there is no need of anxiety in your case; but, wait and see. The probabilities are, that, with all your care, one of your first experiences in hauling bees will be to get your horse stung; and you may be thankful if you get off without a runaway and a general smashup. Some little leak evaded your notice, from which the bees escaped, or you drove your horse too close to the apiary, or in some other way you will have got yourself into such a scrape that you will wish you had had nothing to do with bees. A. E. Manum puts on his horses a covering of cotton cloth which completely covers head and

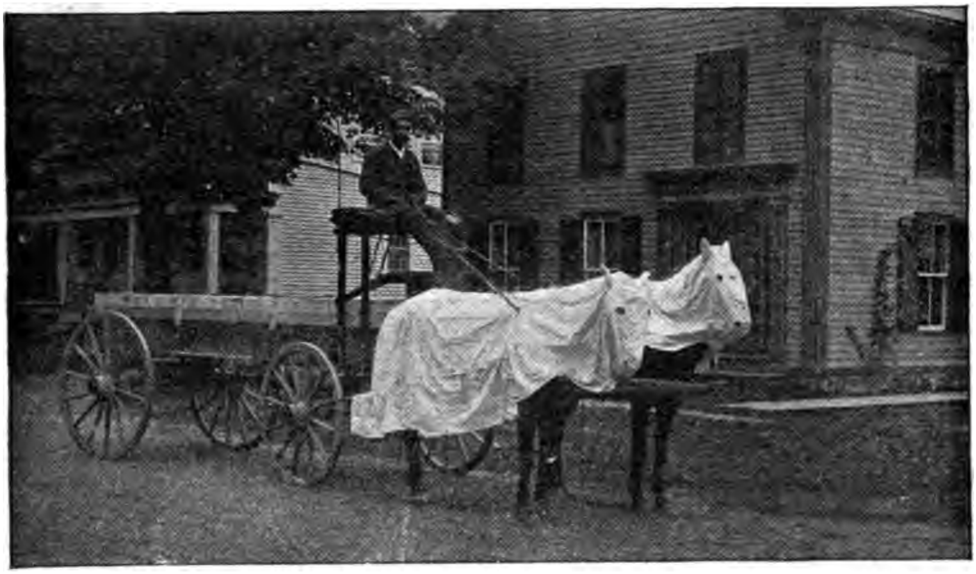


MILLER'S SECTIONAL MOVING-RACK.

body, and this is kept on until some half a mile distant from the apiary.

You may haul bees on almost any kind of vehicle. Some use wagons with springs; some use a hay-rack with two or three feet of hay on it, while others use a common lumber-wagon, or a hay-rack with neither hay nor springs, leaving the frames with no other fastening than the propolis and brace-combs. With smooth roads this latter plan is very satisfactory. With good smooth roads it may be best to have the brood-combs running across the wagon, as most of the shaking comes from the wagon rocking from side to side, while a road very rough may make it best to have the combs running parallel to the line of travel. If the combs are secure enough, it will matter little how they are placed. To carry colonies of bees to advantage, some sort of rack is necessary. As I am not a farmer I had to extemporize a rack for my one-horse wagon. It is made of fence-boards in the manner shown. The hives are set down between the cleats, and between the side and middle strips. I use two of such racks for the ordinary two-horse wagon, placing them end to end. For a light one-horse wagon one rack is sufficient, and for a two-horse rig it is much handier to have the rack in halves.

Whatever the kind of hive you may decide to use, some plan must be adopted, in fastening in the bees, that they may have abundance of ventilation while being hauled. As, however, the hauling is being done in spring and fall, less ventilation is needed than in hot weather. The ordinary entrance, say 14 inches by ⅜, covered by wire cloth, will answer, as that gives a ventilating surface of about 5 inches, although more will be better, and it might be bad to have so little if the day should be warm. Of course, the bees must be shut in when not flying, and in spring it is a good plan to shut up in the evening all that are to be hauled the next day. In the fall the weather may be such that bees will not fly at any time in the day, otherwise you must get to the out-apiary early enough in the morning to shut in all the bees you will haul that day. If you are to take bees to an out-apiary in the spring, the sooner it is done the better, as pasturage is then apt to be rather scarce at best. If bees are to be brought home in the fall to be cellared, they may as well be brought just as soon as heavy frost occurs, or as soon as they stop gathering; at least, they should be brought early enough to have a good fly before going into winter quarters. After being unloaded from the wagon the bees may be liberated at once by blowing in a little smoke or dashing in some cold water; or, if loaded too late in the evening to fly, they may be left till the next morning,



A. E. MANUM'S RIG FOR HAULING BEES AND HONEY TO AND FROM OUT-APIARIES.

when they will be quietly settled down; and if carefully opened, no smoke need be used.

TOOLS FOR OUT-APIARIES, AND WHERE TO KEEP THEM.

Whatever tools you use in the home apiary, you are likely to need the same in each out-apiary. If a different person is in charge of each apiary, then each one must have his own set of tools; and even if the same force go in succession from one apiary to another, it may be the most convenient to have a separate outfit kept at each place. I do not think just now of any thing in the line of tools needed for an out-apiary, different from those that are needed at home, unless it be a robber-cloth. I should not like to be without one of these in the home apiary, but they are specially valuable in out-apiaries where, sometimes, notwithstanding robbers are troublesome, your plans are such that you want to force through a certain amount of work. By having two or three robber-cloths I have sometimes been able to go on with my work when, without them, I should have been obliged to desist. I'll tell you how to make one. Take about a square yard of stout sheeting or cotton cloth; if your hives are small, less will do. Lay one of the cut edges on a piece of lath, about the length of your hive. Lay a similar piece of lath on top of it, and drive wire nails through both, at a distance of perhaps three inches apart. Let the nails be long enough to reach through and clinch. Then treat the opposite edge the same way, and your robber-cloth is complete.

This robber-cloth is exceedingly convenient to throw quickly over any hive or super that you want to cover up temporarily. You can grasp the lath at one side with one hand, and, with a single fling, throw it over a hive and it is instantly bee-tight. It does not kill bees, if any happen to get under it. If you have one hand occupied with something else, you can very quickly uncover and cover with the other. I have sometimes worked with a colony when robbers were so bad they would pounce into every opening; but a robber-cloth covering the frames at each side allowed me to have an opening at the frame I wished to take out. As a general rule, of course, I would try to manage not to work at bees at such times.

But, to return. It would be very convenient, if you go about from one apiary to another, to have a little tool-house at each. I am not sure, however, that it would pay. A hive or box covered over with a water-tight cover (I use a tin hive-cover) answers very well. I would have one or more of these at each apiary in any case, for there are some things you want to be sure of having on hand, as smoker fuel. Matches should also be kept under cover in

WESTLEY DIBBLE'S TOOL, SMOKER, AND FUEL HOUSE.

such a place, in a tin box. A baking-powder box does well. Bee-hats, smokers—in fact, a full set of every thing, may be kept in the same way.

It is possible, however, to get on very well by always taking your tools with you, provided you never forget them. One day we went to the Hastings apiary, without any smoker, and we realized then how important a smoker is. Don't trust to memory. In your record-book have a list of the things you generally need to take; and after you are all in the wagon, or ready to get in, read aloud the list and be sure that every thing is in the wagon, as: Hats, smokers, dinner (we never forgot our dinner), chisel, etc. My own practice has been a sort of compromise between having a full kit of tools at each apiary and taking every thing along. If a buggy is used, it is not convenient to have very much bulk. By the way, a bad season is not without its compensations. I have had two years of such dead failure that we could make almost every trip the entire season in a buggy, for there was no honey to haul, and little in the way of supplies.

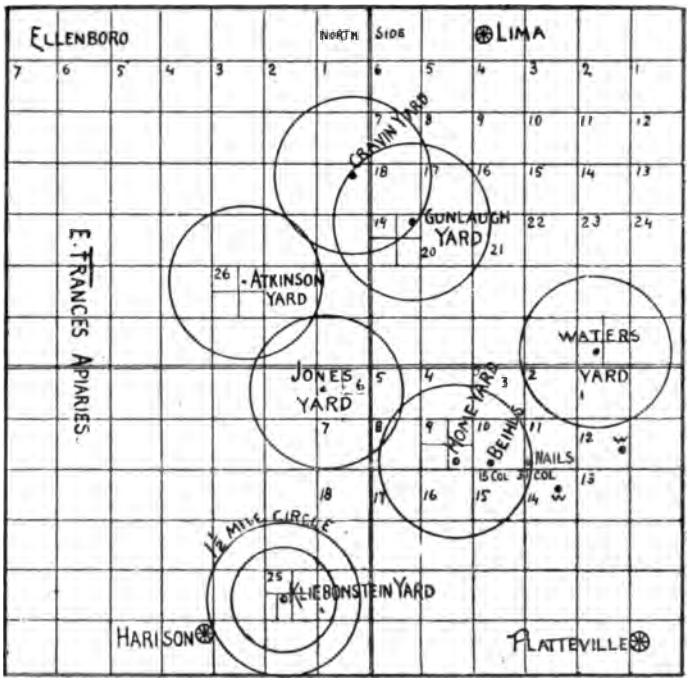
GENERAL MANAGEMENT OF OUT-APIARIES.

The ways of managing out-apiaries will be just as many as the men who manage them; but the general management will be about the same as at the home apiary. There will always be the advantage of mov-

ing at any time a colony or part of a colony from one apiary to another, and feeling sure that the bees will stay where they are put. The more you are interested in out-apiaries the more you are apt to be interested in the prevention of swarming; and if you have been in the habit of wintering in the cellar, an out-apiary will make you debate somewhat the question whether you may not find some way of safely wintering outdoors. Some practice having a competent assistant in charge of each apiary, remaining there all the time; while others have a sufficient force of helpers to go from one apiary to another, doing the work of each apiary as often as convenient, perhaps every six days or oftener.

the home apiary, in a circle, each one in its proper place, just as nicely as we could make it on paper. We have to take such places as we can get, and many of the places that we can get won't do at all, for some reason or other; and when you have six or eight yards planted you will be likely to find, as in our case, some of them badly crowded—too much so for profit.

The circles in the diagram are three miles each, or 1½ miles from center to the outside, which is a very short distance for a bee to go in search of honey. If the bees fly three or four miles, as I think they do in poor seasons, it is plain to see how it works in a poor season. The outside apiaries may be getting a fair living, while the inside yards are nearly starving. In first-class seasons, when honey is plentiful everywhere, and very few bees go over one mile, there is enough for all. I here give the number of bees in each yard this spring, the amount of honey taken, and the amount of feeding this fall to put the bees in trim for winter.



E. FRANCE'S SYSTEM OF OUT-APIARIES.

In *Gleanings in Bee Culture* appeared an article from Mr. E. France, of Platteville, Wis. (see Biographical Sketches); and as it contains so many valuable suggestions, I reproduce it here entire, with the diagram.

I have taken pains to make a correct diagram of the territory that we occupy with our bees; and I must say that I was surprised myself when I saw the exact position of each yard. They are clustered together more than I had supposed. The accompanying diagram will show how they stand, and I will give some facts and figures that will make quite an interesting study about setting out out-apiaries and overstocking our pasture. Of course, it is impossible to locate a set of out-apiaries just so far from

Atkinson yard. Colonies, spring count,	100
Cravin " " " "	91
Kliebenstein yard. " " "	96
Waters " " " "	88
Jones " " " "	80
Gunlauch " " " "	90
Home " " " "	105
Total	649

No increase to speak of

Honey extracted:

Atkinson yard	190
Cravin "	200
Kliebenstein "	740
Waters "	497
Jones "	600
Gunlauch "	350
Home "	540
Total	3125

Fed back:

Atkinson	yard	.000
Cravin	"	.336
Kliebenstein	"	.000
Waters	"	.000
Jones	"	.210
Gunlauch	"	.486
Home	"	.900
	Total	1932
	Surplus after feeding,	1193

Now, notice the Kliebenstein yard, how it is located, away by itself, as for distance, from other yards. It has a great advantage; and then there is plenty of basswood all around it. It has no bees belonging to other parties on its territory. It gave the most honey, no feeding, and is in the best condition of any yard for winter stores.

We will now notice the Atkinson yard. It is pretty well hemmed in on the north and east sides by the other yards, but it has an unlimited field on the west, of good pasture. We took but little honey there, but it is in good condition for winter, without feeding.

Now, away over on the east side we have the Waters yard. It is two miles from basswood, but a splendid white-clover range — plenty of basswood two miles north and east. This yard gave some honey, and required no feeding for winter.

Then there are the Cravin and the Gunlauch yards, each 90 colonies in spring, only 1¼ miles apart—too close, with very little basswood north of them. Both of these yards were fed more honey than we took from them. There were a few acres of buckwheat near them that helped them some. The Jones yard did fairly well, considering its surroundings. It had the least number of bees, an abundance of basswood near, and then had eleven acres of buckwheat just over the fence.

We will now notice the home yard. There were 105 colonies. The Jones yard is rather too close. Then there is an apiary of 20 colonies a little over half a mile east, at a point marked Beihls; another apiary 1½ miles east, 30 colonies, marked Nails; another apiary southeast, marked W, about 40 colonies. Another apiary still further to the east, and a little to the north, marked W, about 40 colonies. So you see the home-yard territory is overstocked the worst of all, and had to be fed 360 lbs. more than was taken from them. The home yard has the best clover field of any, but basswood is scarce within two miles. In looking at the diagram, one not acquainted with the ground would naturally ask, "Why don't you use that open space southeast of the home yard?" It is all prairie land. Corn and oats don't yield much honey.

We will now just look back to the record of a year of plenty, 1886, and see how the yards averaged up then.

COLONIES, SPRING OF 1886.

Atkinson	yard,	72 cols.;	average lbs. per col.,	106
Cravin	"	80	" " " " "	106¼
Kliebenstein	"	60	" " " " "	109
Waters	"	72	" " " " "	107
Gunlauch	"	50	" " " " "	100½
Home	"	61	" " " " "	117

Jones yard not planted then.

FOR 1885.

Atkinson	yard,	56 cols.;	average lbs. per col.,	90
Cravin	"	53	" " " " "	74
Kliebenstein	"	46	" " " " "	62
Waters	"	57	" " " " "	57
Gunlauch	"	46	" " " " "	77½
Home	"	62	" " " " "	71½

FOR 1884.

Atkinson	yard,	51 cols.;	average lbs. per col.,	107
Cravin	"	41	" " " " "	113
Kliebenstein	"	51	" " " " "	109
Waters	"	41	" " " " "	130
Gunlauch	"	41	" " " " "	106½
Home	"	61	" " " " "	113½

FOR 1883.

Four yards, average for the whole............105 lbs.
Number of colonies, 35, 48, 33, 60.

In 1887 we kept no record. It was a very poor season, and we got but little honey.

The year 1884 was a very poor year also.

		Cols. in spring.	Average per col.
Atkinson	yard,	76	23
Cravin	"	75	20
Kliebenstein	"	67	31
Waters	"	69	32
Gunlauch	"	77	21½
Home	"	66	37½

FOR 1889.

		Cols. in spring.	Average per col.
Atkinson	yard,	72	40
Waters	"	79	40
Kliebenstein	"	87	63
Gunlauch	"	79	47
Cravin	yard,	78	49
Whig	"	52	40
Home	"	84	52

Now, friends, you have the figures and the map of the ground that our bees are on. Study it for yourselves. But if you plant out-apiaries, don't put them less than five miles apart if you can help it. If you are going to keep help at the separate yards, to run the bees, six miles apart is near enough; then, if the pasture is good, you can keep from 100 to 150 colonies in each place. If you go from home with your help every day, then you want to gauge the number of colonies so as to work one whole yard in one day; or if you have but three or four apiaries in all, you will have time to work two days in each. But don't go over the roads for less than a full day's work when you get there; and remember, when you are locating an apiary, that, when you are hitched up and on the road, one or two miles further travel will pay you better than to crowd your pasture. Don't overstock your ground. E. FRANCE.

Platteville, Wis.

Soon after the appearance of Mr. France's diagram, there appeared in *Gleanings* another valuable article from the pen of C. P. Dadant, of the firm of C. Dadant & Son (see Biographical Sketches). It substantiates what Mr. France has said, and shows the relation that apiaries bear to each other along on the banks of the Mississippi.

The very interesting article of Mr. France, on out-apiaries, has induced us to give you our experience in this matter, not because we can throw any more light on the question, but because our practice, which extends back to 1871, in the matter of out-apiaries, confirms the views of both Mr. France and Dr. Miller, and will add weight to their statements.

Under ordinary circumstances it is not advisable to place apiaries nearer than four miles apart; but Dr. Miller is undoubtedly right when he says that the configuration of the land has a great deal to do with the greater or lesser distance that the bees will travel in certain directions.

In the accompanying diagram you will perceive that these apiaries are all located on land sloping toward the Mississippi River, and are separated from

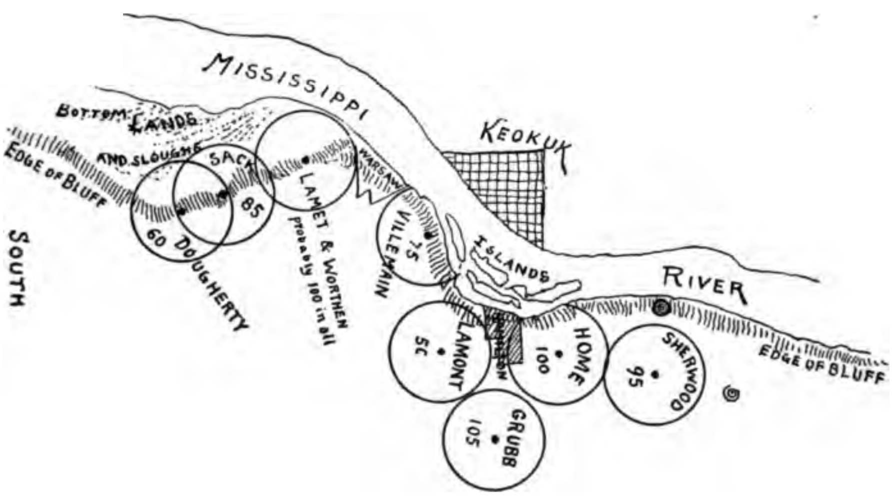
one another by creeks, and groves of timber land. The Grubb apiary is owned by D. W. McDaniel, who has had charge of our apiaries also for a few years past. Of all these apiaries, the Sherwood is the best in the product of both spring and fall crops, although there are seasons like the past when the fall crop fails there altogether.

The Villemain apiary has the poorest location, to all appearances; but it is located near the only basswood grove there is in the country, and has also quite a fall pasture from blossoms that grow on the islands near it. But what will you think of the Sack apiary, which is located a little over two miles south of the Lamet apiary, with another apiary close to the latter, and not shown on the diagram, and only one mile and a quarter north of another apiary of 60 colonies, owned by A. Dougherty? Yet this Sack apiary gives us the best average of honey of all, excepting the Sherwood apiary. The reason of it is, that the pasturage is all west of it on the river bottoms, and very abundant. It is probable that the bees in this apiary go as far west as the river, about three miles, while they perhaps do not travel over a mile east on the bluffs. Their course north and south, in the direction of those other apiaries, is over a hilly country covered more or less with timber, which makes their flight more difficult.

The two small circles in the north part of the diagram show spots on which we have had apiaries formerly, and which, you will perceive, were further away from home than the present. At that time the Sherwood apiary did not exist, nor did the Grubb apiary; and yet we must say that we can see no difference in the yield of the home apiary. We are satisfied that the Grubb bees go east, the Sherwood bees and the home bees northeast, for their crop. When we say the bees go in a certain direction, we do not mean *all* the bees, but the greater part of them. We can give you one convincing instance of the correctness of this opinion.

By glancing at the diagram you will notice that the home apiary is just about a mile and a half from the north point of an island in the river. In certain seasons the islands are covered with water in June; and after the waters recede they become covered with a luxuriant vegetation, and the yield of honey from them very large. In one of these seasons we found a colony, belonging to a neighbor, located half way between us and the river, harvesting a large yield of honey from this source, while our bees harvested nothing. Is it not evident that our bees had not gone that far? Yet we have seen them two miles and more from home in another direction.

Hamilton, Ill. C. P. DADANT.



THE DADANT SYSTEM OF OUT-APIARIES ALONG THE MISSISSIPPI RIVER.

In 1890, and again 1897, I visited a number of extensive apiarists in the States of New York and Vermont. Among others whom I called upon was Mr. P. H. Elwood, who occupies a territory for his system of out-apiaries not many miles from that formerly occupied by Mr. Quinby. Mr. E. runs about 1000 colonies in a series of eight or ten out-yards, and they are located in the valleys in the midst of those York State hills. These hills are anywhere from 500 to 1000 feet high, and are covered with basswoods and clover. As the former are scattered over the hills from top to bottom, the duration of the honey-flow is very considerably prolonged. Instead of there being only ten days or two weeks of basswood, it sometimes lasts a whole month. The first basswoods that blossom are at the foot of the hills; and as the season advances, those higher up come in bloom; and the flow does not cease entirely until the trees at the very top of the hills have gone out of bloom. The bees will first commence flying on the horizontal; and as the season progresses, they will keep flying higher and higher, until they have scaled the top of the hills. Bee-keepers who are situated in such a country, or in swamp land, are in the best of localities for honey. It might be well to observe, in this connection, that these

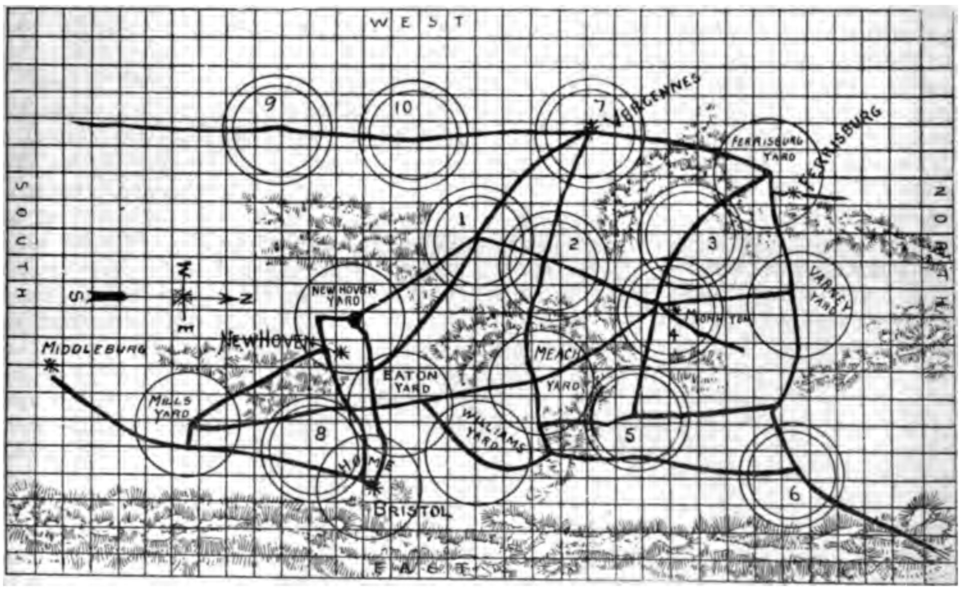
hills form excellent windbreaks for apiarists in the valleys. In Vermont, in a colder climate, this feature cuts quite a figure. Mr. Manum's apiaries are also located among the hills, and in some cases on the sides of the mountains; but, unlike Mr. Elwood, he has no basswood on the mountains.

MOVABLE APIARIES.

Experience has shown, in many instances, **that a yard** that has in years gone by **furnished tons** of honey is now practically **worthless,** or so nearly so that the moving **of the bees** to some location more favorable **is a** necessity. For instance, four or five **years ago** an apiary furnished an abundance **of basswood** honey; but the basswoods **have** all been cut off; there is no clover and the field is worthless. Again, a locality has once furnished immense quantities of white clover; but intensive agriculture has set in, and clover pasturage has given way to immense wheat-fields. The inroads of civilization sometimes cut off the honey-resources of a locality, and, conversely, augment them very considerably. There are a few locations in York State that formerly gave but very little honey; but the farmers, in recent years, have introduced buckwheat to such an extent that these are now splendid buckwheat countries; and the yield of this dark rich honey plays a considerable part in the net profits of the season. In a word, we want our apiaries so we can load them up at a moment's notice, and move them at practically little expense to any new field that may be more inviting. We can not always tell at first whether it will be a favorable location or not. If it does not come up to our expectations, we can "pull up stakes" and try elsewhere again. How are we to make our apiaries movable? Keep them on fixed frames, to be sure. Neither Mr. Elwood, Captain Hetherington, nor Mr. Hoffman fusses with fastening frames. When it becomes desirable to move a yard, all that is necessary is to close the entrance and load up the bees. See FIXED FRAMES.

A SCALE HIVE FOR AN OUT-YARD.

It is a well known and established fact, that one yard may yield quite a crop of honey while another one, only a few miles distant, may require to be fed. It is highly important to be able to tell just what bees are doing at stated periods during the season. Mr. Manum keeps a hive on scales in each yard; and every time he visits one he consults the scales. If they indicate an increase of several pounds, he knows then that the bees in this apiary need more room, and they are also liable to swarm; but if they indicate a loss of several pounds, he infers that the whole yard is losing likewise, and that some colonies may need to be fed. Of course, the hive on the scale should contain a fair average colony. In many cases it is not always possible to visit yards at regular



A. E. MANUM'S SYSTEM OF OUT-APIARIES.

periods, and so Mr. Manum has some resident near the apiary to watch the scale, and report any unexpected developments by a postal card.

A CAUTION ABOUT ENTERING INTO THE OUT-APIARY BUSINESS.

We have already gone over the ground of the general subject of out-apiaries, and what contributes toward making their management a success. While there are many bee-keepers who have brains and capacity enough to manage a series of out-apiaries, there are also many who had better never think of entering into the project. To be a keeper of several out-apiaries means great perseverance and a good deal of system, besides ability to manage not only the bees, but the help who are to take care of them. If you can not make fifty or sixty colonies pay in one location, do not delude yourself by the idea that you can make bees pay if you establish a series of out-apiaries. A man who can not make a small business pay will not probably make a large one do so. If you can manage successfully your home apiary, it may be profitable, as soon as the increase is sufficient, to take a part of it to an out-yard.

OVERSTOCKING. By this term we mean the putting of more colonies in a given locality than that locality can profitably support. By referring to the subject of out-apiaries it will be seen that ordinarily it is not advisable to have more than from 60 to 75 colonies in one yard. While more *can* be kept in one place, it is better, if there are enough to make up another apiary of 60 or 75, to put the excess in another yard two, or, better still, three, and even four miles, from the home yard.[519] But if 75 is just the right number to use in one place, it would hardly pay, if one had 100, to move the extra 25 to a new location; but if he has 50 more than the requisite number, then he had better start another apiary.

A given locality with only ten colonies to gather the nectar in it, may show a wonderful average per colony—perhaps 200 or 300 pounds. When the number is tripled or quadrupled, the average will be cut down a half. The locality should be carefully studied, and only that number of colonies be used which on an average, one year with another, will give the largest results in honey, with a minimum of labor and capital. If 75 hives during an average season would furnish an average of 150 pounds to the hive, then, obviously, the number might be increased to 100 or even 150. If, on the other hand, the average is, say, only 50 lbs. of extracted honey, and there are only 50 colonies in the apiary, then, clearly, 50 would be all there could be kept with profit in that spot; and it might be questioned whether or not 35 might not be just as profitable, and at the same time save a little in the investment and some little labor in gathering and harvesting the crop.

But in some locations, notably in California, Colorado, Cuba, and in some portions of Florida, one can have as many as 300 or 400 colonies, and in some rare instances as many as 500 colonies in one apiary. The celebrated Sespe apiary, in Southern California, owned by J. F. McIntyre, has, in in one spot, some 600 hives of bees; but the great mountains on either side, the fertile valley, and the great abundance of honey flora, make such a number possible. See APIARIES.

OVERSTOCKING AND PRIORITY RIGHTS.

A new phase of overstocking has been developing within recent years, bringing up a rather difficult and serious problem. In good localities such as, for example, the irrigated regions of Colorado, the keeping of bees is much more profitable, or at least once was, than in some of the less favored localities in the central and northern States of the Union. It has come to pass that, in recent years, certain bee-keepers, learning of the wonderful yields in Colorado, in the irrigated alfalfa regions, have started apiaries within less than a mile of some other bee-keeper having 100 or 200 colonies in that locality. When the new comer establishes another apiary of 100 colonies, the place is overstocked, with the result that bee-keeper No. 1 has his average per colony cut down very materially. There is only a certain amount of nectar in the field to be gathered: and if all the colonies get a proportionate share, then bee-keeper No. 2 practically robs bee-keeper No. 1 of a large percentage of honey that he would have obtained had not some other bees been brought into the locality to divide the spoils. But there is no law against such a procedure, and the only protection that the original squatter has is the unwritten moral law that is observed among the better class of bee-keepers, to the effect that no one should locate an apiary so close to one of his neighbors that he will rob that neighbor of a certain amount of nectar in the field which is his by priority of location. In a good many localities in and about Colorado, I am sorry to say that the unwritten moral law is

APIARY OF J. F. M'INTYRE, NEAR VENTURA, CAL.—LOOKING WESTWARD.

only loosely observed. Locations that once afforded an average of 100 or 150 pounds per colony now afford, owing to this species of overstocking, only about 50 or 75 pounds.

On the other side, on this question of priority of right it may be said that the first-comer bee-keeper has in no sense leased, bought, or borrowed the land growing the plants from which the nectar is secreted; that any one and every one has a right to the product from the flowers. Legally the second-comer has just as much right to the field as his neighbor.

I will not attempt to draw out any fine moral distinctions that may be involved in this question, any more than to state that, if a bee-keeper has by luck, careful observation, or at great expense, discovered a locality that yields large amounts of honey, he ought to be left in the peaceful enjoyment and free possession of his discovery, to the extent that no one else should locate an apiary nearer than a mile and a half from any of his apiaries; and right here it seems to me the principle of the golden rule ought to be used to settle such little problems; for it is practically certain that bee-keeper No. 2, who comes into an already occupied field to divide the profits, would not regard with very much favor such action on the part of another if he were in the position of the one having the prior rights.

LOUIS SCHOLL AND HIS TEXAS BEE-YARD. EVERGREEN SHADE ON THE LEFT, AND PRICKLY CACTI ON THE RIGHT.

P.

PEDDLING HONEY. See HONEY-PEDDLING; also see EXTRACTED HONEY.

PERFORATED ZINC. See DRONES.

PICKLED BROOD. See FOUL BROOD.

POISONED BROOD. See FRUIT-BLOSSOMS.

POISONOUS HONEY. There are cases on record, apparently authenticated, that seem to show that honey gathered from flowers of plants that are in themselves poisonous is also poisonous either to human beings or to the bees themselves, or both. Xenophon tells how in the memorable march of the ten thousand Greek soldiers to the sea, some of them were taken seriously ill from eating poisonous honey. The facts are so carefully and minutely recorded as to leave no doubt of the honey-poisoning.

The wild honey in one or two of the Southern States, in a very few isolated localities, is reported to produce sickness, and in some instances this sickness is so sudden and violent that it has given occasion for alarm. In certain regions of Virginia, especially near Halifax Court-house, there is grown in the mountains, quite extensively, mountain laurel. The bees are very fond of it; and while it does not seem to affect them particularly, it is dangerous to human beings, or at least so reported. The plant itself is an extremely distressing narcotic, varying in its effects according to the quantity taken into the stomach. Dr. Grammer, of Halifax Court-house, reports that, during the late civil war, himself and quite a number of comrades were poisoned from eating honey from this plant. There was, he says, a queer sensation of tingling all over, indistinct vision, with an empty, dizzy feeling about the head, and a horrible nausea that could not be relieved by vomiting. This lasted for an hour or so, and the effects did not wear off for several days.

Another honey-plant from which the honey is said to be poisonous is the yellow jasmine, and it is found in certain localities in Georgia, especially in the vicinity of Augusta. The roots, leaves, and flowers are all highly

poisonous; and Dr. J. P. H. Brown, a bee-keeper, says the honey from it is also of like character, as he knows of several persons who came very near losing their lives by eating it. In his opinion bees do not work on it from choice; for when other bloom is yielding honey at the same time, the jasmine flowers are seldom visited.

Notwithstanding these reported cases, Prof. A. J. Cook, of Pomona College, Claremont, Cal., very much doubts whether the honey from any plant is poisonous. Some years ago some incidents were related where bee-keepers had not only eaten of the honey from poisonous plants, but ate of it quite freely, without any ill effects. But the question might arise as to whether they actually ate of the honey from the plants in question, *or from some other harmless plants* that were in bloom at the same time. In a matter involving severe sickness or possible loss of life it would seem to be policy to err on the safe side—that is, to let the honey from mountain laurel, yellow jasmine, and other poisonous plants, entirely alone. If it does not kill the bees, let them have it for brood-rearing, but make no other use of it.

POLLEN. Doubtless you have all heard bees humming about hollyhock blossoms, but perhaps most of you have passed on, thinking that it was nothing strange, for bees are always humming about flowers. Suppose we stop just a minute, and look into the matter a little. The bee, although on the wing, is almost motionless as it hovers about the dust in the center of the flowers, and, by careful watching, we may see that its tongue is extended to a considerable length. This tongue looks much like a delicate pencil-brush as it sweeps it about among the grains of pollen; and as the pollen adheres to it and is from time to time put away somehow, we are led to infer that there must be something adhesive on it. I believe the bee, when it starts out to gather pollen, does carry some honey if it finds some in the blossom. Well, we will suppose it has moistened its long, flexible. brush-like tongue with honey, has spread it out and brushed it among the pollen-grains and then —I rather think I shall have to give you some pictures to explain what happens next.

Fig. 1 is a collection of pollen-grains highly magnified, and A is exactly the kind the bee finds in the hollyhock. There are bristles forming a sort of brush on the under side of the fore leg just above the claws. The bee, when its tongue is well loaded, just claps it between its two fore legs, and in some way which I can not determine to my full satisfaction, the bristles, in conjunction with the claws or hooks, catch the pollen so quickly that it leaves sleight-of-hand performers all far in the shade. I believe it generally wipes its tongue with

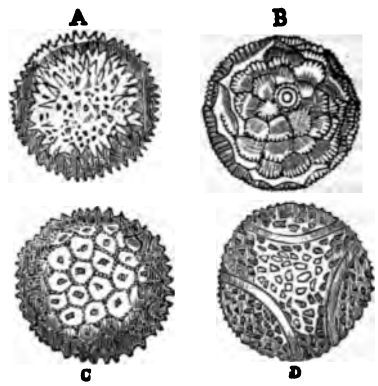


FIG. 1.—POLLEN GRAINS.

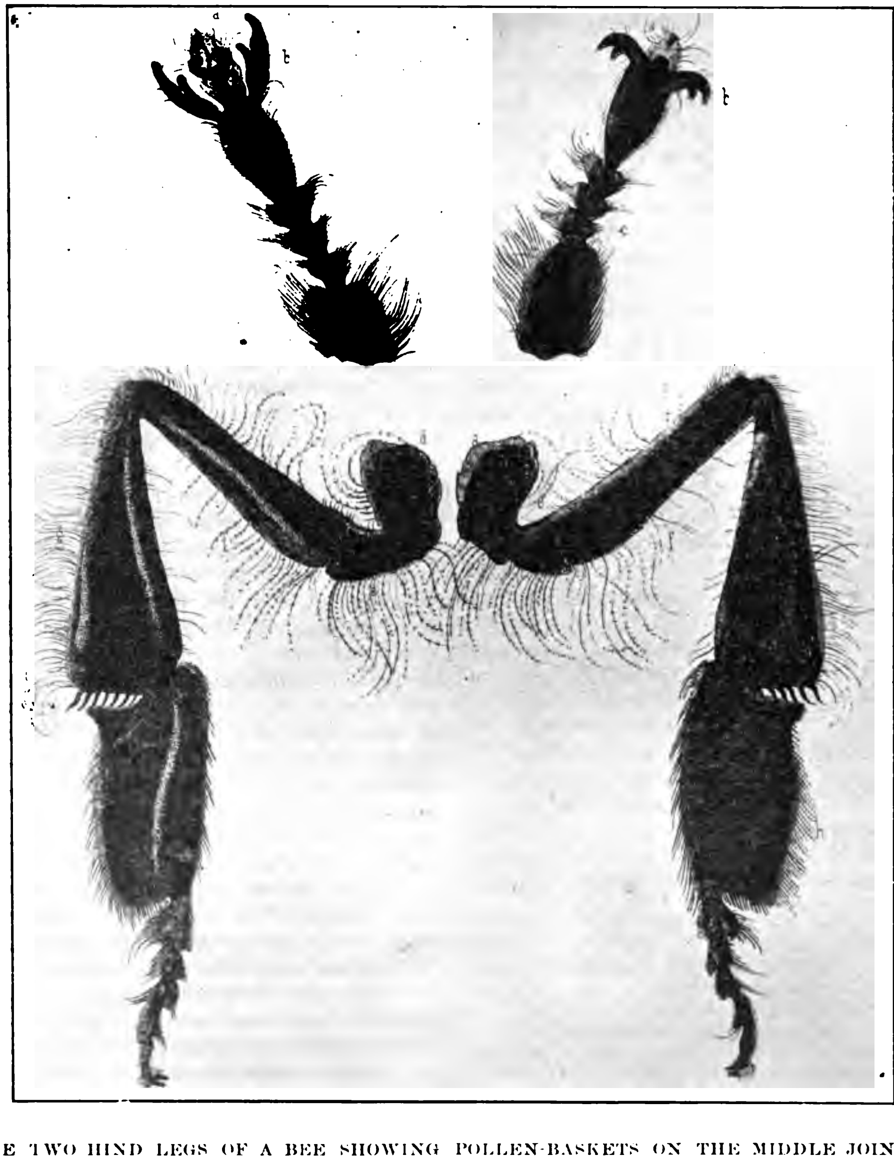
both fore feet at once; and when it does this, its appearance, viewed through a glass, is comical in the extreme. Now it is another "knack" it has, of getting it into its pollen-baskets, after it gets it off its tongue.

Bear in mind that a bee has six legs; the first two legs remove the pollen from the tongue; the last two bear the pollen-baskets. They are called baskets, and are located on the middle large joint of the two hind legs, and they consist of a flat place, or slight depression on the side of the leg, surrounded by a fringe of hairs to hold the pollen from tumbling off. The engraving opposite will give you a good idea of it. Observe the pollen is carried in the upper joint of the leg.

You will see that, should it not moisten the pollen into a kind of paste or dough, it would never be able to make it stick in such a place. Well, it does sometimes tumble off, especially if it takes very heavy loads, or has an inconvenient entrance into its hive. I have seen quite a large heap of pollen, just in front of a hive, when the entrance was so badly arranged as to cause the bee to scrape it off when going in. All kinds of traps and rigging, to prevent the drones and queens from going out and in with the workers, have been objectionable on this very account.

Well, between the pollen-gathering legs and the pollen-basket legs is another pair. These play a very important part in getting the pollen into the pollen-baskets. With the

tongue, fore leg, and middle leg, the bee pads up the pollen and honey until there is quite a wad of it, and then, with a very pretty sleight-of-hand, it carries this little cake, scarcely as large as the head of a small pin, between the middle and fore legs, back to the pollen-basket. When in place, it is firmly pressed into the basket, and then neatly patted down with the middle leg, much as a dextrous butter-woman gives her neat rolls the finishing taps. This motion seems to be a sort of automatic movement; for the bee is the while intently engaged, with tongue and fore feet, in gathering more pollen from



THE TWO HIND LEGS OF A BEE SHOWING POLLEN-BASKETS ON THE MIDDLE JOINTS.

the flowers. The operation may be witnessed easily, by taking on your finger a bee that is gathering propolis from some old quilt or hive. As it picks or pulls off bits of wax with its mandibles, it will convey them back to the pollen-basket much more leisurely while it stands still, and you can easily follow the whole proceeding. Even on a cool day, when its motions are sluggish, you will be astonished at the wonderful celerity and deftness with which these funny little legs move. When it has a load that it deems sufficient, it spreads its wings and soars aloft; but if the field is a new

one, it will circle about and take its points, returning again and again, that it may not mistake where to come back, its plump little load being plainly visible while it is on the wing.

When it gets into the hive, if a young bee, it has to go through with a series of rejoicings—see BEES; but if a regular laborer, it proceeds at once, or at least as soon as it has had a breathing-spell (for carrying large loads of pollen is like carrying a hod of brick to the top of a three-story brick building), to deposit the pollen in the cells. This is done very quickly by crossing its pollen - legs while they are thrust to the bottom of the cell, and then kicking the loads off, much like the way in which our blue-eyed baby kicks off her shoes when she takes a notion to go barefooted.[523] After the load is off, it starts out again without paying any further attention to the matter. The question keeps coming up to me, Does the bee that brings the pollen never stop to pack it in the cells or eliminate it for the young larvæ? I am convinced that it usually does not; but where the hive is deprived of young bees, I think almost any bee can do this work. If there are plenty of young bees in the hive, it probably concludes it has nothing further to do with it.

After the pollen is dropped in the cells, it will fall out if the comb is turned over; and when the maples are first out in the spring, I have heard and seen the pollen rattle out like shot, in turning the combs horizontally to look at the queens. Very soon after the pollen is thus deposited, the nursing - bees come and mash it down into a hard cake; I have not been able to discover how they do this, unless it is done with the head. The *British Bee Journal* for May, 1876, graphically describes the whole operation as follows:

The pollen-laden bee, upon entering the hive, makes directly for the brood-nest; and where its load is required, it quickly disencumbers itself. Sometimes the nurse-bees are in want of the all-necessary pollen, and nibble it from the legs of the worker without ceremony; but more often the bee goes to a cell devoted to pollen-storing, and hangs by its first pair of legs to another cell immediately above, and by the aid of its middle pair of legs it unloads its hindmost, and (as it were) kicks the balls of pollen into the proper receptacle. Here they are mixed with a little honey, and kneaded into a stiff paste, which is then rammed hard against the bottom of the cell, for future use, the bee using its head as a battering - ram; these operations are repeated until the cell is almost filled with the kneaded dough, when a little clear honey is placed on the top, and it is sealed over and preserved as bee-bread. If a cell full of pollen be cut in two longitudinally, its contents will, as a rule, be found of many colors, stratified, the strata of varied thickness standing on edge, as if the bees, instead of storing bread, had stored pancakes.

The principal supply of pollen in our locality is from maple in the spring, and from corn in the latter part of summer and fall.[525] Almost all flowers that yield honey yield pollen also, to a greater or less extent, and when the bee comes in laden with the one, it almost always has some of the other.[150] Red clover yields a peculiar dark-green pollen that pretty surely indicates when the bees are gathering honey from it. They often get a considerable load of honey, with but a very small one of pollen; but if you did not notice very carefully, you would quite likely declare that they had gathered no pollen at all.[531, 151]

The pollen from corn is generally gathered early in the morning; when it is first coming into bloom I have seen them start out in the fore part of the day, much as they do for a buckwheat-field.

For further information in regard to the offices of pollen in the hive, see BEES.

NECESSITY OF POLLEN FOR BROOD-REARING.

We are interested about pollen, because bees can not rear brood without either it or some substitute for it. Bees kept in confinement, and fed on pure sugar and pure water, will thrive and void little or no excrement; but as soon as pollen, or food containing the farinaceous element, is given them, their bodies will become distended; and instead of a transparent fluid they will void a fluid of a darkish tint which will soil their hives and emit quite an unpleasant smell. I once kept about 300 bees in a cage with a queen, and gave them only pure sugar and water. They built comb, and seemed quite contented, the cage emitting no smell whatever. In order to start brood-rearing I gave them some sugar candy containing flour, and they got uneasy very soon, and tried in vain to get out. At this time the cage gave off quite an unpleasant smell, and so they were allowed to fly. Had the pollen element not been given them, I presume they would have stood the confinement for a month or more. I once wintered a fair colony of bees on stores of pure sugar syrup, and when they flew in the spring there was no perceptible spot on the white snow about their hives. They had no pollen, and, of course, no brood - rearing could go on without it. A few years ago I made some experiments with bees confined in a large room under glass. As it was late

in the fall, after brood-rearing had ceased, I did not know whether I should succeed in starting them again. After feeding them for about a week, eggs were found in the cells, but none of them hatched into larvæ. A heap of rye meal was placed in the center of the room near the feed, and anxiously I waited to see them take notice of it. After several days a bee was seen hovering curiously about it. In breathless suspense I watched it until it finally began to dip its tongue into the heap, and then to pad it on its legs. It carried home a small load. I had the hive open, and the frame out, as soon as it was among its comrades, and watched the behavior of the rest while it shook itself among them, until it deposited its treasure in a cell, and hurried away for another load. Very shortly some of the rest followed it, and buzzed about the room until they found where it was loading up, and soon they were at work on the meal, as merrily as in the spring. Of course, the eggs were very soon, now, transformed into unsealed larvæ, then into capped brood, and, in due time, I had young bees hatched out in the month of December.

By warming the room with a stove for several days in succession, I found I could start brood-rearing and pollen-gathering even in the month of January. It may be well to state here, that although I succeeded in rearing bees in midwinter, as strong and healthy, apparently, as those raised in summer time, the experiment was hardly a success after all; for about as many bees died from what I suppose was the effect of confinement as were hatched out. It was a decided success, in determining many unknown points in regard to bees, aside from the office of pollen; and I presume, if it ever should be necessary, we could overcome the difficulties of flying bees under glass.

ARTIFICIAL SUBSTITUTES FOR POLLEN.

It has been known for many years, that in the spring time bees will make use of the flour or meal of many kinds of grain, and many bee-keepers feed bushels of it every season. The favorite seems to be rye; and, as the bees are apt to fall into it and sometimes get so covered as to perish, I have been in the habit of having the rye ground up with an equal quantity of oats. A great many plans have been devised for feeding it without waste; but, after all our experiments, a heap of meal on the ground is about **as satisfactory as any way.[535] Of course, it should be protected from rain; and as there is usually much high wind in the spring, which is, to say the least, very annoying to the bees, it is well to have it in a spot sheltered as much as possible, always aiming to give them as much sunshine as may be.** By way of experiment, I have concentrated the rays of the sun on the meal heap by mirrors, that the bees might work on days otherwise too cold; I have also made glass covered structures for the purpose; and have even kept their meal hot by means of a lamp-nursery; all these plans have succeeded, but I am inclined to doubt whether stocks pushed along in brood-rearing, by such means, were really in advance of some that were left to take their chances. It is amusing to see the little fellows start from their hives on days so cold that they would not otherwise stir out, hie to the warm meal and load up, and then go home so quickly that they do not have time to get chilled.

Is there any danger of feeding them too much meal? In our own apiary I have never known them to take so much that it was not used at once for brood-rearing; but I purchased of a neighbor some hives which contained flour in the cells, dried down so hard as to make it necessary for the bees to cut it out, comb and all, as the only means of getting rid of it. I presume this came about by the sudden appearance of natural pollen, when they had laid in a pretty good supply of the flour. It is well known that, as soon as the natural pollen can be obtained, they at once abandon all artificial substitutes. I think there is but little danger of giving them too much rye and oat meal, but I would not risk giving them great quantities of fine wheat flour.

Not a few of our readers have been perplexed and astonished, doubtless, by seeing the bees, in early spring, greedily appropriating sawdust, just as they do rye meal. I have seen them at the sawmills, so thick on a large heap of fresh sawdust as to attract a large crowd of people; and when I caught them, and tasted of the pollen from their legs, I was somewhat amazed to find it sweet and very much like the pollen from the flowers. I presume they had plenty of honey but no pollen, and that these fine particles of wood contained enough of the nitrogenous element to answer very well, mixed with honey, as they have it, when packed in their pollen-baskets. The pollen from green timber contains an essential oil, besides some gummy matter, that gives an odor doubtless **reminding the bees of the aroma of the opening buds. Not only do they thus collect the**

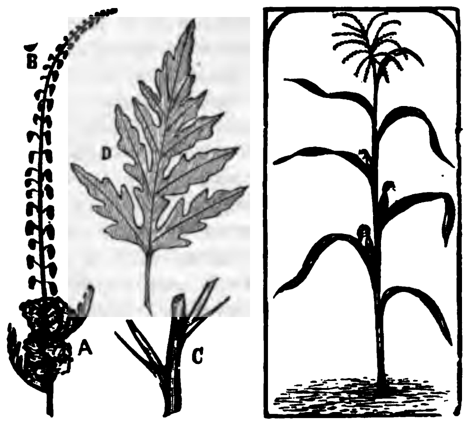
(to us) tasteless sawdust, but they have been found at different times on a great variety of substances. A friend in Michigan at one time found them loading up with the fine black earth of the swamps, and they have been known to use even coal-dust; but the strangest thing of all was told me by the owner of a cheese-factory, near by. He said the bees were one day observed hovering over the shelves in the cheese-room, and, as their numbers increased, they were found to be packing on their legs the fine dust that had accumulated from handling so much cheese. Microscopic investigation showed this dust to be embryo cheese-mites, so that the bees had really been using animal food as pollen, and living animals at that. If one might be allowed to theorize in the matter, it would seem this should be a rare substance to crowd brood-rearing to its uttermost limit. As cheese can be bought here for 6 or 8 cts. by the quantity, it might not be so very expensive for bee-food after all.

Bees can be taught to use a great variety of articles of food in this way, when they are in need of pollen, and therefore the story of giving a hive of bees a roasted chicken, to promote their comfort and welfare, may be not entirely a myth. Ground malt, such as is used in making beer, has been very highly recommended in place of rye meal; but as I have never succeeded in getting any of it I can not speak from practical experience.

THE AGENCY OF THE BEES IN FERTILIZING PLANTS, BY MINGLING THE POLLEN.

This subject has been discussed under FRUIT-BLOSSOMS, but I will here give a few more examples. A perfect blossom contains both stamens and pistils, the male and female organs of reproduction; but sometimes we find flowers having stamens only, and others having pistils only; and these two blossoms may be borne by the same plant or by different plants.

If I am correct, the plant is fertilized by the pollen from the anthers falling on the stigma at the summit of the pistil. Unless this is done, the plant ripens no seed. Nature has adopted a multitude of devices for carrying this pollen from one blossom to the other; but perhaps the most general, and the one with which we have to do principally, is the agency of the bees. Common corn is an illustration of a class of plants that bear both kinds of blossoms on the same plant. The blossom that bears the seed is low down, and is what we commonly term the silk of the ear. The one that bears the pollen is at the very summit of the stalk, and the pollen, when ripe, is shaken off and falls on the silk below; or, what is still better, it is wafted by the wind to the silk of the neighboring stalks, thus preventing in-and-in breeding,



RAGWEED AND CORN, SHOWING THE TWO KINDS OF BLOSSOMS ON ONE STALK.

in a manner strikingly analogous to the way in which the drones fly out in the air, that the chances may be greatly in favor of their meeting queens other than those from their own hives. You may object, that the silk from the ear of corn is not properly a flower, so I will give you a more striking instance. The common ragweed, *Ambrosia artemisiæfolia*, also sometimes called bitterweed, or hogweed, bears two distinct and entirely unlike flowers.

On the ends of the tall racemes, as at B, the pollen-bearing blossoms are seen very conspicuously; and many of you who are familiar with the weed, perhaps never imagined that it had any other blossom at all: if so, will you please go outdoors and take a look at them again? Right close to the main stem, where the branches all start out, you will find a very pretty little flower, only that it possesses no color except green, and it is here where all the seeds are borne, as you will see on some of the branches where they are matured. Now, if you will get up early in the morning you will find that these plants, when shaken, give off a little cloud of fine green dust, and this is the pollen of the plant. Before I knew what it was I used to find it annoying on account of the way in which it soiled light clothing. As this plant is in no way dependent on the bees for the fertilization of its blossoms, they contain no honey, or at least I have never been able to detect any; although I have, during

two seasons, seen the bees quite busily engaged gathering the pollen. It is said that corn sometimes bears honey as well as pollen, although I have never been able to get proof of it. These two plants, as I have before remarked, seem to insure crossing the seed with other plants of the same variety, by bearing the pollen-bearing flowers aloft, on slender stalks; also by furnishing a great preponderance in numbers of these blossoms, for precisely the same reason that a thousand or more drones are reared to one queen. A stalk that succeeds in pushing itself above the others, and in bearing a profusion of pollen-flowers, will probably be the father, so to speak, of a multitude of the rising generation, and this process, repeated for generations, would develop just the tendency of corn and ragweed, to shoot up tall spires, clothed with an exuberance of the pollen-bearing blossoms. As the plants that give the greatest distance on the stalk between the lower (or seed) blossoms, and the upper ones, are most likely to shed the pollen on neighboring plants, this, too, fosters the tendency mentioned.

But what shall the great multitude of plants do that have no tall spines with which to shake their pollen to the breezes? Here is where the bees come in and fulfill their allotted task in the work of animal and vegetable life. They would, it is true, visit many plants for the pollen alone; but with by far the greater part of them the pollen is only a secondary consideration, or not sought for at all. In vieing with each other, or in the strife to perpetuate their species, what shall the plant do to offer the greatest attraction to the bees to visit them, and carry the precious pollen to the neighboring blossoms, for the purpose we have mentioned? Suppose we wish to gather a group of school-children about us, what will be the surest and most effectual method of doing it? Coax them with candy, maple sugar, and the like, of course; and that is just what the plant does; or it does still more, for it ransacks its storehouse, and, I dare say, sends its roots abroad through the soil, with untiring efforts, to steal a more delicious and enticing nectar, more wonderfully exquisite than even the purest and most transparent maple-sugar syrup ever distilled, or "boiled bown," by the skill of man, for the sole purpose of coaxing the bees to come and dust themselves in their precious pollen, or to bring from some other blossom the pollen they have previously been dusted with. Now, this honey is precious, and it must tax the plant to its utmost to produce it. Nature, therefore, who is a most careful economist, not only deals it out in small doses, but she places it in the most cunning nooks and corners, that the bee may be obliged to twist itself into all possible shapes, around and among the stamens, until the pollen is most surely dusted all over it. Observe that the flower secretes no honey until the pollen is ripe and ready to do its work; that the honey slowly exudes into the nectaries, that the bees may be kept coming and licking it out every hour in the day; and that the flow of honey ceases just as soon as the pollen is ripened and gone. A lady has suggested a beautiful experiment, to determine the amount of honey yielded by the spider-flower, *Cleome*. She tied lace over the stalk, to keep away the bees that were constantly visiting it. The honey collected in quite a large drop. I presume we could measure the amount with many other plants in a similar way. The little cups on the flower of the FIGWORT, I have seen full to the brim with honey, when found standing alone out in the woods. Truly:

> "Full many a flower is born to blush unseen,
> And waste its sweetness on the desert air."

Did you ever notice the spot of fur, or down, on the back of the bee, just between the wings? Well, bee-hunters sometimes put a small drop of white paint on this spot, that they may know a bee when it comes back. Several years ago bees were going into many of the hives, with a spot of white on this fur that looked, at first sight, almost like white paint. For several seasons in succession I hunted in vain to see where they got this white spot. At one time it seemed to come from working on thistles; but I was obliged to give this up, for I found it most on the bees one season when they did not notice thistles at all. One swarm of beautiful Italians had filled their hive nicely in September, and almost every bee had a white back. I lined them from the hive, and followed them. They went toward a large piece of wild woodland, and I scanned the tops of the trees in vain; finally, over between the hills, beside a brook, I found acres of the wild touch-me-not (*Impatiens*), the same plant that we have often played with in childhood, because the queer little seed-pods will snap all to pieces when ripe, if they are touched ever so carefully. The honey is secreted in the spur of the flower, shown at B.

The bee can reach this only by diving down into it almost out of sight; and when

the coveted treasure is obtained it backs out with a ludicrous kicking and sprawling of its legs, and in so doing the down on its back is ruffled up the wrong way. Now

FLOWER OF THE WILD TOUCH-ME-NOT, SHOWING THE WAY THE BEE GETS THE POLLEN ON ITS BACK.

this would be pretty certain to get the pollen dusted all over it; but nature, to make sure, has planted a little tuft that bears the pollen just on the upper side of the entrance to the flower, at A, and, in its struggles to get out, the white pollen is brushed all over its back most effectually, to be carried to the next flower, and so on.

Throughout the animal and vegetable kingdoms there seems to be a constant struggle for the perpetuation of their species, which is secured only by ripening perfect seeds. Notice how the weeds in our garden will struggle and fight, as it were, to get a foot-hold until they can get a crop of seeds ripened, and then notice the numerous ways they adopt to scatter this seed as widely as possible. If the plants were animated beings, we might almost call it tricks and sharp practice; some of the seeds have wings, and fly like grasshoppers; others have hooks, and catch on our clothing, and on the fur of different animals, in the hope of being carried to some spot where they may have a more favorable place to germinate. Fruits and berries, instead of clothing themselves in the sober green of the foliage surrounding them, when the seeds are fully ripened affect scarlet red and other bright colors, and, sometimes, fancy stripes, just to induce the birds to take them in preference to the fruit of other trees. Why do they want their fruits to be eaten by the birds, if it is their purpose to secure a place for their seed? Well, if you examine, you will find that the seed is encased in a horny shell that is proof against the digestive organs of the bird, and these seeds and stones are, therefore, voided frequently, if not invariably, while on the wing, in just the condition to take root in the soil wherever they may be cast. Bear this in mind while we go back a little to the bees and flowers.

I have suggested that the honey is placed in the flowers to attract the bees; after a bee has found honey in one flower it will be very likely to examine others of a similar kind or appearance. If the flowers were all green, like the leaves of the plant, the insects would find much more trouble in hunting them up than they now do, because the contrasting color, such as the white or red of the clovers, makes them conspicuous. If you look back to what I said about corn and ragweed you will see that the flowers of both are a plain green, for they have no need of bees to insure their fertilization.

It is easily proven that bees have a sort of telescopic vision that enables them to perceive objects at long distances. When a bee starts out in the morning it circles up aloft, then takes a view, and starts out for business. If one field of clover should be more conspicuous than the rest, it would probably give it the preference—at least, so far as to make an examination. If it has been at work on a profitable field the day before, it will, doubtless, strike for it again without any preamble. That bees look for honey, and hunt it out, I have proven to my full satisfaction; and I am well convinced that what is often called instinct, and allowed to drop there, is only profiting by experience, and an excellent memory of past events, much in the same way human beings do. We say that bees instinctively go to the flowers for honey. I have watched them in the spring when the blossoms first open, and many a one, very likely a young bee that has never before seen a blossom, will examine the leaves, branches, and even rough wood, of the trunk of the tree, intently smelling and sniffing at every part, until it finds just where the coveted treasure is located. After it has dived deep into one blossom, and tasted the nectar, it knows pretty well where to look next.

The touch-me-not has learned, by ages of experiment, to produce a bright orange flower, to secrete honey in the spur, to place the pollen-bearing stamens at the point where the bee must rub against them in getting the honey, to construct those wonderful seed-pods, which explode and scatter the seed far and wide, just that it may reproduce and multiply its species. I should judge it had succeeded pretty well in a waste piece of woodland near my home, for there are now acres of it as high as one's head, and it is quite a valuable acquisition to our apiary.

As nearly as I can make out, the plant has much increased since the advent of the Italians, as might be expected; and instead of having a dearth of pasturage for several months in the fall of the year, we not only have honey enough so that the bees trouble the houses and groceries very little, but they amass sufficient stores to carry them through the winter, with little if any feeding. This is true of dandelions as well: and the large, brilliant, showy blossoms that now line our roadsides and waste places, instead of unsightly weeds, should remind one of how much an apiary of bees contributes to fulfill the words of sacred prophecy:

The wilderness and the solitary place shall be glad for them; and the desert shall rejoice, and blossom as the rose.—*Isaiah* 35 : 1.

Now, I can not positively affirm that the flowers were given their gaudy colors by the bees' selecting the brightest and most conspicuous, thereby inducing such blossoms to bear seed in preference to those less gaudily attired, neither do I know that cherries became red because the birds selected those that showed a disposition to that color, year after year, for many centuries; nor can I prove that the bright plumage of male birds came about in the course of time, simply because the female encouraged the attentions of and showed a preference for those most handsome. I can only suggest that the actions of birds, bees, flowers, and fruits, seem to point that way. You all know how quickly we can get fancy-colored flowers, yellow queen-bees, or birds of almost any shade or color, by careful selection for several generations. Have not the bees so colored the flowers, and birds the berries, etc., although they did it all unconsciously?

My friend, before you again complain because you have found a cell or two of bee-bread in your comb honey, would you not better ponder on the wonderful agency which those simple grains of pollen exert on the plant life that is yet to come, years, perhaps, after we have faded away and gone?

POLLEN IN SECTION BOXES AND COMB HONEY.

I do not mean to convey the idea that we should be satisfied with pollen in our honey, for a very good and useful thing is sometimes a very bad one, if out of place. When pollen or meal is brought into the hive, it is taken, at once, very near to the brood; in fact, it is placed in the comb opposite, if possible. **When opening hives in the spring, we find pollen scattered all through the brood-combs to some extent; but the two combs next to the two outside brood-combs are often a solid mass of pollen.** Should a few stormy days intervene, however, this will disappear so quickly that one who has not witnessed the rapidity with which it is used in brood-rearing would not know how to account for it. When it is gone, of course the brood-rearing must cease, although the queen may continue to lay. The amount of brood that may be reared by keeping a stock supplied with pollen artificially, during such unfavorable weather, is a very important item, where rapid increase of stock is desired.

Using the candy slabs with ¼ or ⅛ wheat flour is, perhaps, the surest way of doing this. See CANDY FOR BEES.

A friend has a house-apiary, where the combs are pretty deep, and no upper story is used. His comb honey was all secured in frames containing sections at the side of the brood. When asked if the bees did not deposit pollen in the sections when used in that way he replied, "Not if a comb is interposed between the brood and the honey." This is because they always want the pollen next the brood. Now, we can get more comb honey by having it near the brood than in any other way; what shall we do to keep out the pollen, and to keep the queen from laying eggs in our surplus-honey sections? The remedy I have adopted, and advised through this work, is the use of separators, with the small one-pound section boxes; for it is well known that the queen is averse to using small pieces of comb, or comb near much wood. In our own apiary, I have never known the queen to deposit eggs in these sections, when thus prepared, even if they are placed next the brood-combs; but others have written that they are, at times, filled with both brood and pollen, even when thus prepared. If I could see the hives I think I could find the trouble, yet there may be exceptional cases. The frames or sections used in the lower story are more likely to be filled with pollen than those in the upper story; for if the wide frames and sections are so made that but about ¼-inch space is left for the bees to go up into them, the queen is very unlikely to attempt to go up. An occasional cell of pollen will sometimes be found, which I regret the more, because such combs are much more likely to contain worms, if taken out in warm weather. If it were not for this small, accidental quantity of pollen, I am not sure we should ever find worms in the comb honey. See BEE-MOTH.

POLLEN IN THE SECTIONS AS THE RESULT OF CONTRACTING THE BROOD-CHAMBER TOO MUCH.

Pollen will be forced into the surplus apartment if contraction (see CONTRACTION) be carried too far. The brood-chamber of an 8-frame Langstroth brood-nest should not be contracted, as it is quite small enough; but a larger hive may perhaps be contracted to two-thirds of its full size. During one season, when the honey-flow was rather meager, desiring to get all the honey into the sections that was gathered, we contracted the brood-nest of two or three of our best colonies down to two or three frames. This, of course, left the bees very little room for the storage of honey below, and, as we reasoned, the overplus of honey would go above right speedily, which it did. The bees went to work in the sections, without any trouble. The supers of these colonies were filled, while colonies whose brood-chambers were moderately contracted made no demonstration above. When, however, we came to take off the honey at the close of the season, from the first-mentioned colonies, we found that it contained more or less pollen. The sections from the colony which had only two brood-frames contained the most pollen.

A fair average colony will bring in just so much pollen, and they will put it somewhere. They prefer to put it in and around the brood; but if this is denied them they will put it "upstairs," just where we don't want them to put it, especially when running for comb honey. Had not queen-excluding honey-boards been placed between the upper and lower stories, the queen, no doubt, would likewise have deposited eggs in the sections; for, of course, her field of labor was considerably reduced. Indeed, reports have been received where such excessive contraction has resulted in depositing eggs in the sections, when no queen-excluders were used. In view of the foregoing, if you desire to keep brood and pollen in their proper places, do not contract; the practice has generally gone out of vogue any way.

QUEEN-EXCLUDING HONEY-BOARDS NOT NECESSARILY AN EXCLUDER OF POLLEN.

It is said, that the strips of perforated zinc in the slatted honey-board will largely prevent the storage of pollen above. From what experience we have had, I am inclined to think the zinc will discourage it to some extent; but from the incident above related it will be observed that, if contraction be carried too far, the bees will put the pollen where they please, zinc or no zinc.

HOW TO START BEES AT WORK ON RYE MEAL.

A beginner hears the feeding of oatmeal highly recommended as a substitute for pollen. He places some near the entrances of the hives, but not a bee touches it. He is told again to wait until early spring, before the bees have access to natural pollen, and then they will take it. He does so, but, as before, not a bee notices it. He is next told to put a heap of it in the sun, a few rods distant from the hives. This time he may succeed; but it would not be strange if he should once more report that his bees would have nothing to do with it. Finally he is directed to take a piece of honey and get some bees to feeding on it, then to set it on the heap of meal. The bees soon gather over it in great numbers; those who go home loaded start out many more searching all about the vicinity, to see where the treasure comes from. The hum of the busy ones on the honey soon attracts them, and, in snuffing about the pile of meal, some bee discovers that it can be used as a substitute for pollen; the others soon follow suit, and, in a little time, both the bees and their owner are happy, and the pile of meal quickly disappears. After this he never has any more trouble in getting the bees to work on meal, for he *knows how*. The bees and their owner have both learned a valuable lesson about pollen. Is there any very great difference in the way they have been taught? Did they not both learn by practical experiment? 539

PROPOLIS. This is the gum or varnish that bees collect for varnishing over the inside of their hives, filling cracks and crevices, cementing loose pieces of the hive together, and for making things fast and close generally. It collects, in time, on old hives and combs, so as to add very materially to their weight. It is not generally gathered in any great quantity until at the close of the season, and it seems to be collected in response to a kind of instinct that bids them prepare for cold weather. I wish I were able to tell you more definitely where they get it; it has been suggested that it is collected from the resinous buds of the balm-of-gilead, and trees of a like nature; but, to tell the truth, I do not know that I ever saw bees collecting fresh propolis at all. I see them almost every day collecting propolis from old hives, old quilts, and pieces of refuse wax, when we are so wasteful and untidy as to leave any such scattered about. That the principal part of it comes from some particular plant or class of plants, or

tree, I am pretty well satisfied, for almost the same aromatic resinous flavor is noticeable, no matter what the locality or season of the year. Bees gather propolis with their mandibles, and pack and carry it precisely as they do pollen. It is never packed in the cells, however, but is applied at once to the place wanted. It is often mixed with wax, to strengthen their combs, and is applied to the cells as a varnish, for the same purpose. In the absence of a natural supply, the bees frequently resort to various substances, such as paints, varnishes, resins, pitch, and the like; and the superstition, popular in some sections, that bees follow their owner to the grave, after his death, probably obtained credence from seeing the bees at work on the varnish of the coffin. To save the bees the trouble of waxing up the crevices in their hives, it has been suggested that a mixture of melted wax and resin be poured into the hive and made to flow along the cracks and corners. This may do very well, although I fancy the bees can do this better and cheaper than we can. Our principal trouble has been to get rid of the surplus propolis, and I should much rather hear of some invention to keep it out of the way than to add more.

HOW TO KEEP PROPOLIS FROM SURPLUS HONEY.

Of course, the readiest means is to remove all sections just as soon as a single one is capped over; and, as but little propolis is gathered during a strong yield of honey, but little will be found on the honey, unless it is left until the yield has ceased. The bees not only cover all the wood-work of the sections if left on too long, but they also varnish over the whole surface of the white capping, almost spoiling the looks and sale of the honey.

It is next to impossible to keep propolis from the sections entirely. Bees will deposit at least some in the interstices between the sections. As Nature abhors a vacuum, so bees seem to abhor a crack or crevice. The nearer we can get surplus arrangements so as to leave but few crevices or places of contact accessible to bees, the less propolis will be deposited. Some surplus arrangements are made so as to produce compression upon the sections, thus reducing the space formed by contact with sections to a minimum. Some prefer to have the outside of the sections covered entire. This can be accomplished either with the wide frames or with surplus arrangements having the top and bottom so as to cover the outsides of the sections. For removing propolis from sections, see COMB HONEY.

HOW TO REMOVE PROPOLIS FROM THE FINGERS.

A variety of substances have been suggested. Alcohol is perhaps the neatest, but is rather expensive; benzine or gasoline, or common lye for soap-making, answers nearly as well, and is cheap; soap will answer, if a little lard be rubbed on the hands first, but will have little effect on it otherwise. A friend down south says he has a pair of light cotton gloves which he slips on when handling the waxy frames, and his hands are left clean whenever he is obliged to stop work. For removing it from glass, etc., alcohol is perhaps best. When we have much glass soiled, it can often be cleaned most expeditiously by boiling it in a kettle of water with a quantity of wood ashes, or, better, lye. Right here I can not do better than to reprint an article by Miss Wilson, Dr. Miller's assistant, from *Gleanings in Bee Culture*.

When I cleaned the T tins with concentrated lye, I felt pretty sure that hives, supers, separators, etc., could be cleaned in the same way, but was so busy I could not take time just then to experiment, so concluded to say nothing about it till I could find time to test the matter. This morning, May 5th, being the first opportunity I have had, I concluded to experiment a little.

I put on my wash-boiler with water and lye, then went to the shop and selected the most badly propolized supers and separators that I could find as fit subjects on which to experiment. I dropped a few separators into the boiler while the water was yet cold, to see what effect it would have on them. I couldn't see that it affected them in the least until the water almost reached the boiling-point, when the propolis disappeared.

What I was most afraid of, was that the separators while wet would cling so closely together that the lye would not reach every part, and that they would not be perfectly clean. I was glad to find these few did not bother at all, but came out perfectly clean. I stirred them with the poker while boiling, although I don't know that it was necessary, as I tried another lot without stirring, and they came out just as clean. I next tied up a bundle of 59 separators, that being the number I had handy. Of course, they were tied loosely. I dropped them in, having a strong cord tied around the middle of the bundle to lift them out by. I let them boil two or three minutes, and took them out; 32 of them were perfectly clean. The rest, the center of the bundle, still had some propolis left on, and were treated to a second dose.

Taking a very large quantity of the separators at one time, there might be more trouble than I think, about getting them clean, but I don't believe there would be if the water were kept hot enough, and enough of the lye used. I don't think any harm would come from having it unnecessarily strong.

I next tried dipping the T supers. My boiler w

large enough to clean only half a super at a time, so I had to dip in one half, reverse it, and dip the other half. Had I been able to dip one all at once, I think I could have cleaned one a minute. And they are beautifully cleaned. I don't know of any other way they could be cleaned so nicely—quite as clean, I think, as when new. We scraped all our supers before the lye was thought of; and while they are much improved by the scraping, they are not nearly as nice as when cleaned with lye, and the scraping is harder work.

I did not have any thing large enough to dip a hive into, but of course a hive would clean as readily as a super. With convenient apparatus to work with, a large number of such articles as separators could be cleaned at a time with no very great amount of labor. It is such a comfort to have every thing clean! Wood separators are so cheap that we have always thought it did not pay to clean them. I rather think we shall conclude that it does pay, after this, providing we can get them satisfactorily dried in good shape.

Marengo, Ill. EMMA WILSON.

DO THE BEES NEED PROPOLIS?

Much discussion has arisen in regard to the habit of the bees, of making all openings tight with propolis. Theory says, if allowed to follow its bent, or instinct, it will smother itself to death. Practice says, it does, at least at times, so prevent the escape of moisture that its home gets damp and wet, filled with icicles, etc., so that it suffers; or, at least, such is the case in the hives we have provided for it. Who is right—the bee or the enlightened bee-keeper? Well, I think the greater part of the fault lies in the hive we have given it. The enameled cloth which we formerly used for covering bees is as impervious to air and moisture as the propolis they collect with so much pains and trouble. If the outside of this is allowed to get frosty, it will, most assuredly, condense the breath of the bees on the inside; and if the outside is but thinly protected from the weather, icicles will certainly form on the inside, and freeze the bees all fast in a lump. Now I would have no fear at all in having the bees wax up every thing as tight as they wished, if I could have their winter apartment made so small that they completely filled it—filled it so full, indeed, as to be crowded out at the entrance, unless in very cold weather—and have the entire outside protected with some non-conductor that would enable the bees to keep the inner walls warm at all times. I think then we should have no dampness. With chaff packing and chaff cushions, I have succeeded so well that I am perfectly willing the little fellows shall fix up just as snug for winter as their instinct prompts them to do.

VALUE OF PROPOLIS.

The gum has been used to some extent in medicine; also in the preparation of certain leather polishes. It is claimed that propolis for this purpose possesses a property that renders it superior to any of the pitches or resins.

REMOVING WAX AND PROPOLIS BY STEAM.

A friend sends us the following, which will prove very serviceable when one has a steam-boiler convenient:

I have tried all the formulas for cleaning wax from utensils, and, in my experience, have found that concentrated lye cleans it off faster and more thoroughly than any thing else. All the methods are troublesome, and it takes time to clean, especially the perforations. My plan of cleaning wax from the perforated basket of the wax-extractor is, to have two pieces of gas-pipe, each one foot long, just large enough to screw into the sprinkler of the fountain pump. Attach the sprinkler to one end of the pipe, procure a globe valve, and screw this on the other end; screw one end of the other piece of pipe on the globe valve, and the other end into the steam-boiler, about one or two inches below the water-line. Open the valve, and spray the articles covered with wax, with steam and hot water. You will be astonished to find how quickly it makes things look like new.

J. A. PRITCHARD.

St. Gabrielle, La., Aug. 8, 1879.

PRIORITY RIGHTS. See OVERSTOCKING.

Q.

QUEEN-REARING. Every honey-producer should know how to raise his own queens. There are times when it is better to buy them, and other times when it is certainly cheaper to rear them. Other things being equal, a queen that has never been compelled to go through the mails, shut up in mail-sacks, to be bumped about in this way and that for a period of two or three days or perhaps that many weeks, ought to live longer and give better results than one that is compelled to undergo such treatment. It very often happens that a queen that has been doing excellent service for a year or so, after being sent through the mails, and introduced, dies within a few days, for the very probable reason that the journey was too much for her. It would seem, then, that every bee-keeper should himself rear the majority of the queens that he uses, buying only just enough to renew his stock, or to introduce new strains. Where one has nothing but blacks or hybrids in his vicinity, it will be difficult to produce pure queens; and usually under such circumstances it is more practicable to buy largely.

CONDITIONS FAVORABLE AND UNFAVORABLE FOR REARING QUEENS.

When a colony from some cause or other becomes queenless, the bees will set about rearing another. If it is after the swarming season they may or may not select larvæ of the right age, and they may be in such haste to rear one that what they do raise will be a poor little inferior black queen hardly bigger than a worker. Such queens should be killed, and good ones put in their place.

In nature, the best queens are those that are reared either during the swarming-time or when the bees are about to supersede an old queen soon to fail. At such times we see large beautiful queen-cells, reminding one of big peanuts, projecting from the side of the comb. The larvæ in such cells are lavishly fed with the royal food; and when the queens finally hatch they are usually large and vigorous.

I said there is one class of cells that the bees rear when they are about to supersede an old queen. When one gets to be two or three years old she begins to show signs of failing. The bees recognize the fact that their own mother will soon die, or at least need help from a daughter, and very leisurely proceed to construct a number of cells, all of which are supplied with larvæ, and fed in the same lavish way as those reared under the swarming impulse.

But we can never determine in advance when the bees will rear supersedure cells, and it may be true that the queen about to be superseded is not desirable stock from which to rear. In this case such cells should not be utilized. For a like reason, also, cells reared under the swarming impulse should be rejected; for in any case it is penny wise and pound foolish to rear queens from any thing but the very best select stock. But all swarming-cells from good queens should be reserved. I would advise placing them in West queen-cell protectors; then I would hunt up queens two or three years old, pinch their heads off, and put one of these cells in their colonies. But perhaps you say you have good queens even two or three years old. Perhaps; but the majority of our honey-producers think it profitable to replace all queens three years old, and a good many make it a practice to requeen all colonies having queens of two years and over.

While these swarming-cells will produce the very best of queens, it may not be convenient to requeen during the swarming season, and in some localities it may be a very bad time of year for it owing to the interruption that it will make in the regular production of honey; for it is well known that a good many colonies will not do as well in honey-gathering when they are queenless as when they have a good queen in the hive. But such cells even then can be given to nuclei, for they ought not to be wasted.

I have said there are several methods of queen-rearing. The first one that I will

describe is the Doolittle method—a plan that he introduced in 1889, and described very fully in his book, "Scientific Queen-rearing."

THE DOOLITTLE METHOD OF REARING QUEENS.

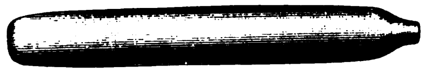
While Mr. Doolittle's system is artificial in a sense, yet he endeavors to make this method or methods conform as nearly as possible to Nature's ways. The first thing of prominent importance in the rearing of queens is to bring about conditions that will approach, as nearly as possible, those that are present during the swarming season, at a time when the bees supply the cell-cups lavishly with royal food. One of the first requisites, then, for cell-building is strong powerful colonies; second, a light honey-flow, or a condition almost analogous, viz., stimulative feeding if the honey is not coming in. Queens reared during a dearth of honey, or in nuclei, are apt to be small, and the cells from which they come look small and inferior. The mothers that do the best work are those that are large, and capable of laying anywhere from 2000 to 3000 eggs per day. A queen that is incapable of this should not be kept. For instance, a colony with a good queen might earn for its owner in a good season $5.00 in clean cash. In the same season the same colony (or, perhaps, to speak more exactly, the same hive of bees), with a poorer queen, would bring in less than half that amount. A queen that can lay 2000 or 3000 eggs a day at the *right time of the year*, so that there will be a large force of bees ready to begin on the honey when it does come, is the kind of queen that we need to rear.

HOW TO MAKE DOOLITTLE CELL-CUPS.

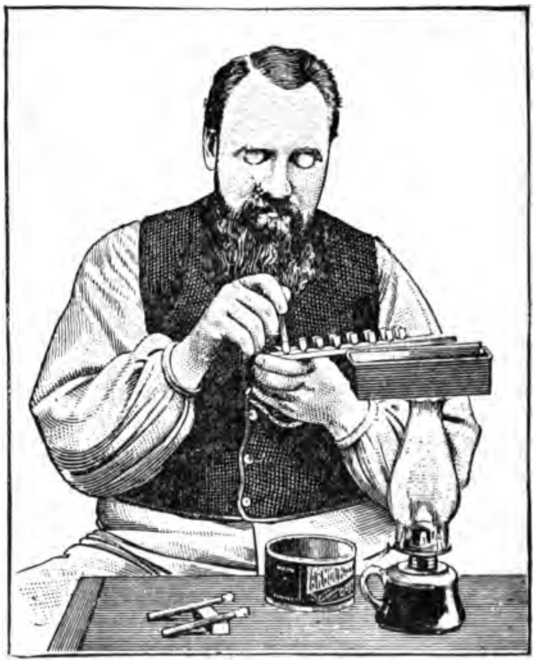
Many times, when an apiarist is going through his yard, he can cut out embryo cell-cups, such as the bees make. These can be utilized at some future time for the purpose of grafting. But such cells, after they are gathered, are exceedingly frail, irregular in shape, will not bear much handling; and most of the time one can not find enough.

Mr. Doolittle was the first who conceived the idea of making artificial cell-cups that should not only be regular in form, but of such construction as to stand any reasonable amount of handling; and, contrary to what one might expect, such cells are just as readily accepted by the bees as those they make in the good old-fashioned way; and, what is of considerable importance, they can be made in any quantity and by any one of ordinary intelligence.

Mr. Doolittle takes a wooden rake-tooth, and whittles and sandpapers the point so that it is the size and shape of the bottom of

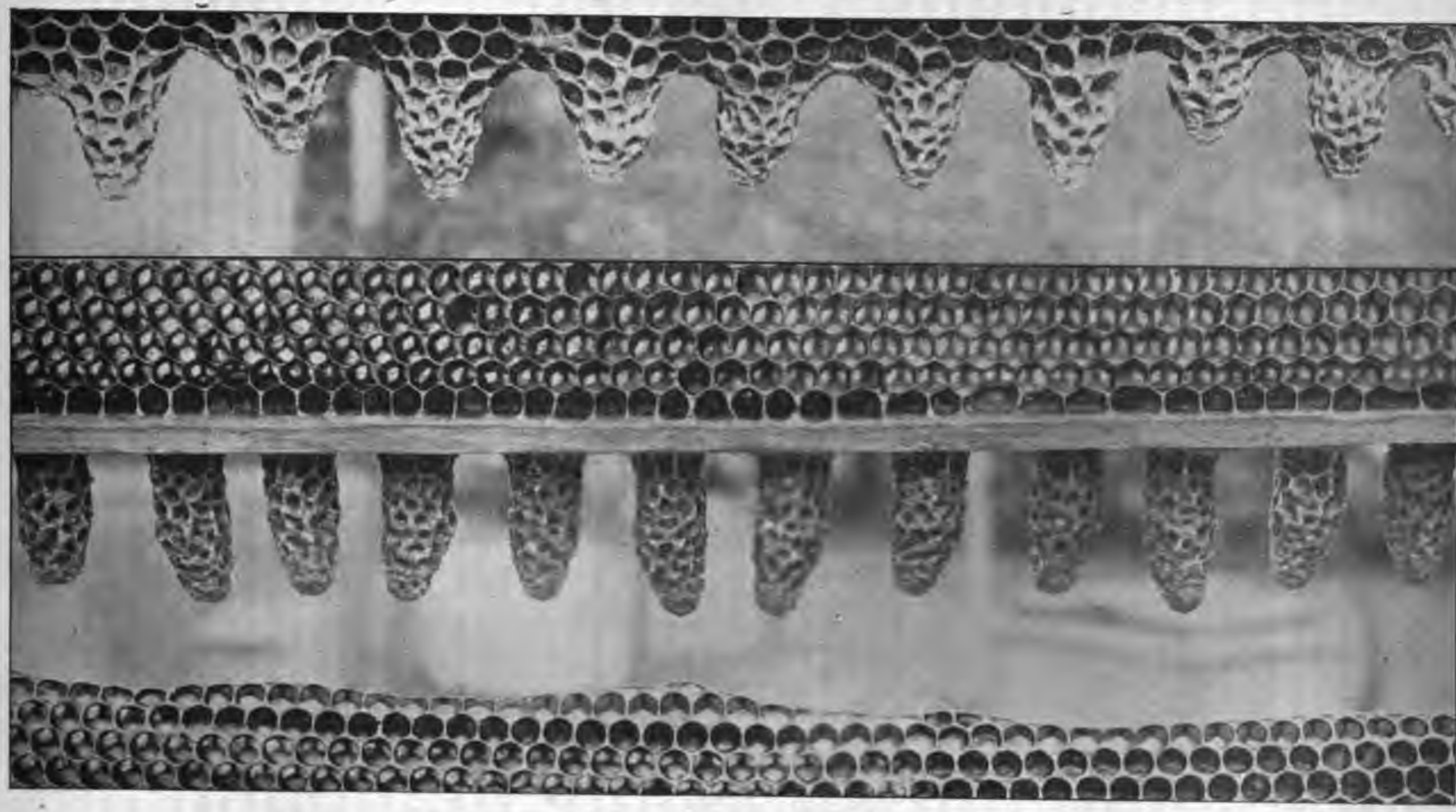


the queen-cell (see illustration). Two or three other sticks are then fashioned of the same shape and pattern. Preparatory to forming the cells Mr. Doolittle has a little pan of beeswax, kept hot by means of a lamp; also a cup of water. Seating himself before a table he is now ready for work. Taking one of these cell-forming sticks, he



DOOLITTLE MAKING CELL-CUPS.
From Doolittle's Queen-rearing.

dips it into water, after which he plunges it about $\frac{3}{16}$ of an inch into the melted wax. He then lifts it up and twirls it at an angle (waxed end lowest) in his fingers. When cool he dips it again, but not quite so deep, and twirls it as before. He proceeds thus until the cup is dipped seven or eight times, but each time dipping it less depth, or within $\frac{1}{32}$ inch of the previous dipping. The main thing is to secure a cup having a ***thick***



A SAMPLE OF DOOLITTLE CELLS (FULL LIFE SIZE) REARED AT OUR OWN QUEEN-REARING YARD.

heavy bottom, but which will have a thin and delicate knife edge at the top, or at that point where the bees are supposed to begin their work. After the last dipping is cooled, a slight pressure of the thumb loosens the cell-cup slightly. It is then dipped once more, and before it is cool it is attached to a comb or a stick designed to receive it. And that brings me to the point that Mr. Doolittle has his cell-cups fastened in rows on a stick, this stick being fastened in a brood-frame. More cell-cups are fastened on the aforesaid stick at regular intervals, as shown in the cut.

Cell-cups can be made in a much more wholesale manner by mounting several sticks at regular intervals in a cross-bar. The whole, when completed, looks something like a rake-head. The *modus operandi* is as follows: The teeth of this rake are dipped into melted wax to the required depth; and just about as the drops of wax begin to form on the end, the whole is given a shake, disengaging the drops. It is next dipped in the same manner, but to a less depth, and given another shake, and so on until the required number of dippings have been made (see Pridgen method, spoken of further on). The average bee-keeper had better follow the plan with one stick, as he will be likely to obtain better results.

GRAFTING CELLS.

The next operation is to insert a small particle of royal jelly in each queen-cell so made. The amount in each should be about equivalent in bulk to a double-B shot, says Mr. Doolittle. But we have found that a much less quantity will answer. Out of an ordinary queen-cell well supplied with royal jelly we get enough to supply 20 cups. If we took a quantity equal in bulk to a BB shot we would have to rob two or three cells to supply 20 cups. This royal jelly should come from some queen-cell nearly ready to seal, as that will contain the most royal jelly. The jelly should be stirred to bring all of about the same consistency, after which it may be dipped out of the cells by means of a stick whittled like an ordinary ear-spoon, or a toothpick bent to that shape.

The next operation is take a frame of young larvæ just hatched from the egg from our best breeding queen. Even if the larvæ are from one to two days old it will do no harm. Each little grub should be picked up with the aforesaid ear-spoon, and gently laid in the royal food previously prepared in one of the cell-cups. A larva should be given to every one of the cell-cups in this manner, and when all are supplied they are to be put into the cell-building colony.

Now, then, after this cross-stick has been mounted in a brood-frame we are all ready for the bees to begin where man left off. If it is during the swarming season I would select some *strong* colony having a queen, place on top of it a queen-excluding honey-board, and over it an upper story with a few frames of brood. If the colony is already a two-story one, a perforated zinc-board should be inserted between the two sections of the hive. Into the upper story of such a colony we place our frame with prepared cells between two frames of brood and bees. If the colony is *strong* enough the bees will go to work immediately, drawing out the queen-cells, giving them an added supply of royal jelly, and finally completing them as shown in the large illustration on preceding page.

While he *can* use these upper stories already containing a queen for the drawing-out of cells *before* and *after* the swarming season by giving their bees stimulative feeding, yet more extended experience has shown that a larger percentage of cells, and just as good ones, will be secured from a strong *queenless* colony that has been made queenless, broodless, and eggless four or five days previous to the giving of the cups. But it is important at the time of making this cell-building colony queenless to begin stimulative feeding, giving them half a pint of syrup daily. After the lapse of four or five days a frame of prepared cell-cups as before directed should be given, when the bees are almost crying for a queen or for something from which they may start cells. Under such circumstances they will immediately accept the cups and draw them out, feeding them lavishly with royal food, and the cells will be equal to any swarming cells.

But a cell-building colony to be preferred above all others outside of the swarming season is one having a queen which it is trying to supersede. One or more such colonies will be found in a large apiary, but as a rule the queen is hardly good enough to breed from. Having found our colony, we begin giving it daily feeds at once, as this is a prime requisite for the best results in cell-building with any colony, either with a queen or without one. This supersedure cell-building colony will not only draw out and complete one set of cups but several sets in succession; but it is best not to give any one such colony more than a dozen or a dozen and a half of prepared cups at a time.

Allow it to finish up one batch, and then, if necessary, give it another.

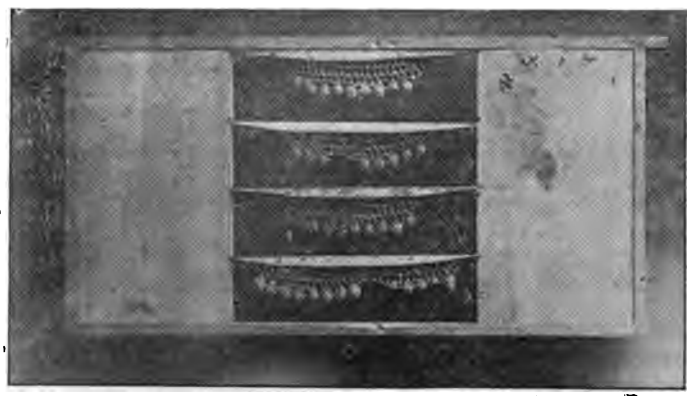
To one of our supersedure colonies, as we call them, we gave one batch of Doolittle cups after another until they had completed over 300 fine cells; but we were careful to take away each lot before any could hatch, of course, for a young virgin would very soon make havoc of the other cells unhatched, and besides would get the colony out of the notion of trying to supersede the old queen.

Just how far supersedure bees will continue to build out batches of cell-cups one after another, I am not able to say; but if they are fed half a pint of syrup daily they appear to be willing to keep up the work indefinitely, in the hope that they will some day be able to rear a virgin that will supplant the old queen that appears to be failing.

THE ALLEY METHOD OF SECURING CELLS.

The veteran queen-breeder Mr. Henry Alley, of Wenham, Mass., has for something over twenty years used a method that is essentially different from the Doolittle. His plan of procedure is as follows: He goes to his select breeding colony, and from it takes out a frame of eggs almost ready to hatch. From this he cuts out a piece of comb about four inches square. This he shaves on one side so that the cells are about half their original depth. He next cuts it into strips, running a knife through alternate rows of cells. He now takes one of these strips, and with the head of a match destroys the egg or larva, as the case may be, of each alternate cell on that side of the comb that has been cut down half depth. In a like manner he treats the other strips. These strips of comb are secured to sticks by melted wax and then mounting in a brood-frame in the manner shown; that is to say, the ends of the sticks engage in notches of the sides of two ⅞-inch boards fastened on each side of the brood-frame. When properly done, the strip of comb will have the cells

WORKER-COMB FOR CELL-STARTING A LA ALLEY.



COMPLETED CELLS FROM WORKER-COMB.

shaved down, pointing toward the bottom-bar. One of these prepared frames is finally placed in a strong colony that has been made queenless and broodless four or five days before. As I have already pointed out, such a colony fairly howls or cries in its distress for something with which to start cells. If they are fed by giving them half a pint of syrup daily they will immediately begin to work building out large lavishly fed cells: and if every alternate egg has been destroyed, only every other worker-cell is used for building a queen-cell.

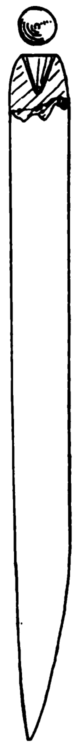
DRONE - COMB PLAN OF REARING CELLS.

This is almost the same as the Alley, with this difference: Empty *drone* comb is used instead of worker. Every afternate cell* is grafted with a larva or egg, after which it is given a minute part cle of ro al jelly †, as has been explained in the Doolittle method. These strips of drone comb are then mounted on a stick, as explained in the Alley plan, and placed in a hive that has been made queenless and broodless four or five days before.

These drone-cells can be given to colonies trying to supersede queens, or the upper story of a colony having a queen, and the cells will be drawn out and completed as are Doolittle cups when made artificially. But I should not think it practicable to give worker comb by the Alley plan to the upper stories of colonies, for the reason that royal jelly in the cells is quite necessary to get the bees to start them in colonies not queenless.

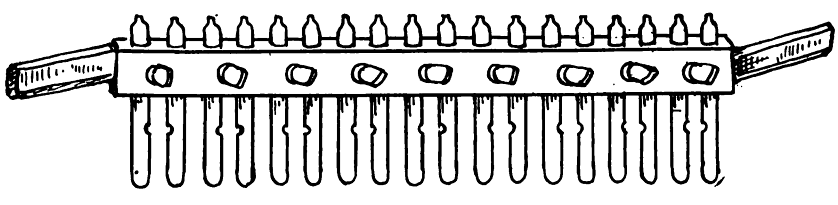
PRIDGEN METHOD OF REARING QUEENS.

Mr. W. H. Pridgen, of Creek, N. C., has developed a system of queen-rearing that differs somewhat from all these methods, or rather, I should say, it is a combination of all. He makes Doolittle cell-cups in a wholesale way by dipping 20 or 30 sticks at a time. These cups at the bottom, when complete, are reduced down to about the size of a worker cell, and in appearance they look like little goblets. Mr. Pridgen shaves down a piece of worker comb with young larvæ from his breeder so the cells are about $\frac{3}{8}$ in. deep. He then bends the comb back and forth along the line of the cells from which he wishes to take his larvæ, and in such a way as to partially loosen the cocoons in the cells. He now takes a stick, the diameter of a worker-cell, but which has been hollowed out on the under side, so that it is cone or cup shaped. He gently pushes this stick down into a cocoon until it strikes bottom, the hollowed-out end resting down over the larva and the milky food in which it is enveloped. By twisting the stick a little he loosens the cocoon until it adheres to the stick. He now lifts it out and inserts it in the bottom of one of his artificial cell-cups, or goblets. Again giving the stick a little twist he loosens the stick from the cocoon, leaving the cocoon fastened in the cup. In this way he inserts cocoons with their contents in a series of cups mounted on a stick equally distant from each other.



It will be noticed this plan differs from the Doolittle in the manner of transferring the larvæ, and that instead of royal jelly only the milky food designed for worker brood is used.

These cell-cups with their transferred cocoons are now inserted in cell-building colonies. So far this plan is similar to the one used by the Atchleys, except that they transfer the cocoons by means of tweezers; but Mr. Pridgen's method, according to our experience, is the more easily practiced.



The question will naturally arise, Which of the methods described for securing cells is the best? This I can hardly answer. Excellent results can be obtained with any one of them. Much will depend upon what one is used to. If he has tried one plan and it works well, let him stick to that. Perhaps

* It would be better to graft every third cell—that is, leave two empty cells between cells with larvæ. This allows more room for cutting apart when cells are completed.

† J. D. Fooshe, a breeder of large experience, considers the giving of royal food as unnecessary.

 QUEEN-REARING.

more breeders use the Doolittle method because it has been more generally described in the bee-journals. It is certainly true that hundreds of bee-keepers have been and are using it, considering it the *ne plus ultra* of *all* methods.

QUEEN-CELL PROTECTORS.

Having told about how to rear cells, the next point to consider is what to do with them. They can be put directly into nuclei; but it is usually advisable to slip them into

THE WEST QUEEN-CELL PROTECTOR.

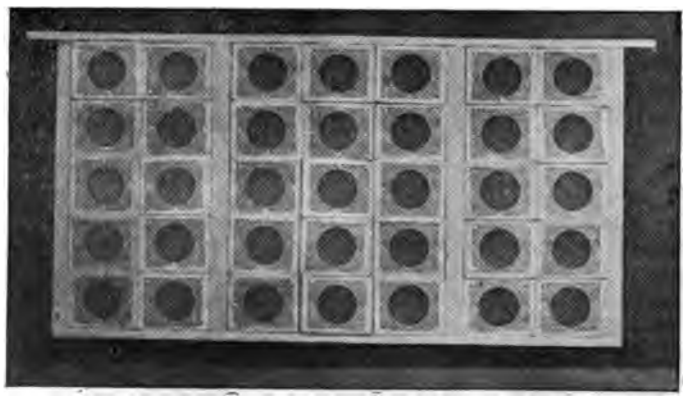
a queen-cell protector. The best one I know of is the West, making use of a sort of cage made of coiled wire.

One of the cells is to be slipped into one of these protectors, and the tin slide shoved into place, as shown in the illustration. This protector, having a wire sticking out at right angles, can be easily attached to any comb. When the queen hatches she simply emerges from the end of the cell in the usual way, for the end of the protector is left open. Strange as it may seem, the queen and bees do not attempt to destroy or open a cell except at the sides. If these portions are protected, and the end left exposed, as in the cut of the West, the royal mother-to-be in her waxen cradle will not be molested.

FORMING NUCLEI FOR CELLS.

Under NUCLEUS, elsewhere, I described how to form nuclei, so it will not be necessary to go over the whole ground here. But Mr. Doolittle uses a method that may be employed to advantage, and I'll describe it right here. It is similar to the Somerford plan spoken of under NUCLEUS. It is this: We go to any strong colony between the hours of 10 in the forenoon and 2 in the afternoon, when the bees are flying the strongest—a time when all or nearly all of the *old* bees will be off to the fields. If these *old* bees were taken to a new location they would be sure to return to the parent stand. We therefore desire to get as many of the *young* bees as possible when we make the division, because they will stay right where they are put, and at the same time will be more kindly disposed to the queen-cell we give them.

Out of this strong colony to be divided during the middle of the day we take a frame of brood and adhering bees, and then put with it, in another location, a frame of honey from this or any other hive. If the hive to receive this nucleus be a full-sized one, a division-board should be put in so as to contract the space down to one or two frames as the case may be. The entrance should be closed, and the nucleus left for 48 hours to accustom the bees to their new location, at the end of which time—that is, just at night—the entrance is to be opened, and a queen-cell given to the bees. More nuclei can thus be formed until all but one of the frames of brood of the colony are used up. This should be left for the returning bees; and, if they are made queenless, a queen-cell should be given.

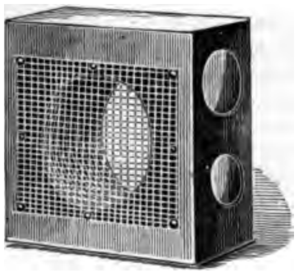


ALLEY'S QUEEN-NURSERY.

But there may be times when we shall have a surplus of cells and no nuclei. In such a case cells may be inserted in little wire-cloth cages, and the cages hung in an

ordinary brood-nest between two frames of brood.

The cage Mr. Alley uses is shown in the accompanying illustration. He takes an ordinary block about 2¼ inches square, and bores a 1¼-inch hole through it. On one side, as shown, he bores a small hole to hold can-



dy or feed for the queen. A little nearer one edge he bores another hole ¾ inch in diameter, and within ⅛ inch of the large 1¼-inch hole. He then takes another bit, ½ inch in diameter, and bores clear through it. This leaves a shoulder to hold the queen-cell so the point projects into the large hole. Both sides of this block are covered with wire cloth, and enough of them are made to fill out a brood-frame. These cells we will insert in these wire-cloth cages described, and then put the cages into a brood-frame, as shown in the next engraving. The whole is now set down into a colony of bees, and the young queens are allowed to hatch.

FERTILIZING QUEENS FROM UPPER STORIES

Queens can be fertilized in upper stories separated from a lower one by means of perforated zinc; but the conditions under which such a plan can be made a success occur so rarely that the average person had better let it alone. We succeed, however, very nicely; but instead of perforated zinc we use wire cloth, so that bees from the lower hive are entirely shut off from those of the upper, except that the warmth of the cluster from below can easily go above.

We take an ordinary upper story, tack a wire-cloth bottom on it, and divide it off into three bee-tight compartments longitudinally. The separating partitions reach from the top edge of the super or cover to the bottom, or wire cloth, so that there will be three compartments, each shut off from the others, and each taking one or two standard L. frames. To each compartment there is a small entrance; and in order to prevent the queens from getting confused, and from going into the wrong entrance, one compartment has its entrance on one side, the middle compartment one on the rear end of the super, and the remaining compartment the other side. For the purpose of forming these fertilizing nuclei, a frame of brood with adhering bees is put into each division. To each frame there is added a frame of honey. Last of all, to each is given a cell about ready to hatch. The cover is put on; and when the queen hatches she will fly from her entrance the same as from any nucleus, and return fertilized. The warmth of the bees from below, if the colony is strong (and it should be, of course), will easily keep the super with three little nuclei warm throughout.

By the plan above given we are enabled to get *three* queens fertilized to each strong colony instead of only one; and yet during the time the colony below is in no way interfered with.

HOW TO INTRODUCE VIRGIN QUEENS.

Almost any queenless colony will accept a virgin queen that has been out of the cell for about 24 hours; but after they have been out longer, say three or four days, it is not so easy a matter to get the bees to accept them. In fact, it is much more difficult to introduce a virgin four or five days old than an ordinary fertile queen; but it sometimes happens that we do not have nuclei that can take the cells or queens at just the right time, so we have to let these queens remain in these cages until we have nuclei to spare. This often results in having virgin queens anywhere from three to four days old.

But these four and five day virgin queens can be introduced providing one exercises due precaution and patience. Under INTRODUCING we have illustrated and described the Miller introducing-cage. Put the old (?) virgin into one of these cages. Plug the hole up with candy, and then tack over the end of the hole a piece of cardboard. The bees will gnaw away the pasteboard and then eat out the candy, all of which will take four or five days. This length of time will usually cause the bees to be favorably disposed toward the virgin, and she will be fertilized in due course of time.

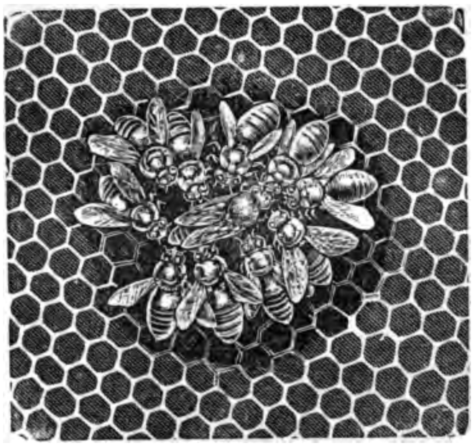
Colonies having queen-cells just sealed will be more apt to accept virgins than those that have just been made queenless. Still, we have successfully introduced them by the plan spoken of, even in colonies just made motherless, at the time of putting in the Miller cage, but it must be at least four days before the bees get at the virgin.

Young virgins just hatched can usually be

allowed to run in at the entrance of a queenless nucleus; but if you desire to take greater precaution daub her in honey and then let her loose.

QUEENS, HOW TO FIND. See FRAMES, TO MANIPULATE.

QUEENS. The most important personage in the hive is the queen, or mother-bee. She is called the mother-bee because she is, in reality, the mother of all the bees in the hive. So much has already been said of queens, in DRONES, and QUEEN-REARING, that I presume our A B C class are already pretty well acquainted with her majesty, as she is frequently designated.



THE QUEEN AND HER RETINUE.

If we deprive a colony of their queen, the bees will set to work and raise another, so long as they have any worker-larvæ in the hive with which to do it. This is the rule, but there are some exceptions: the exceptions are so few, however, that it is safe to assume that a queen of some kind is present in the hive, whenever they refuse to start queen-cells from larvæ of a proper age.

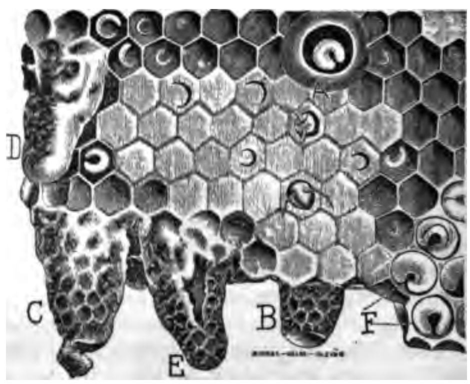
IMPERFECTLY DEVELOPED QUEENS.

Some queens are small, usually dark in color, and will sometimes become fertilized, and lay eggs for a little while (all the way from a week to several months), but they are never profitable. Sometimes they will not lay at all, but will remain in a colony all through the season, neither doing any good nor permitting any other queen to be either introduced or reared. A wingless queen, or one with bad wings, will produce the same result. The remedy is to hunt them out and remove them. Where they are so near like a worker-bee as to make it hard to distinguish them, they may often be detected by the peculiar behavior of the bees toward them. See INTRODUCING QUEENS, also cut on preceding column.

HOW A WORKER-EGG IS MADE TO PRODUCE A QUEEN.

This is a question often asked, and it is one that puzzles me about as much to answer as any question a visitor can ask. I cannot promise to tell you all about it, but I will tell you all I know about it. We will first get a frame of eggs, as we did in studying BEES, but we will vary the experiment by putting it into a colony having no queen. The minute eggs will hatch into larvæ as before; but about as soon as they begin to hatch, if we look carefully we shall see some of the cells supplied with a greater profusion of the milky food than others. Later, these cells will begin to be enlarged, and soon at the expense of the adjoining ones. These are queen-cells, and they are something like the cup of an acorn in shape, and usually occupy about the space of three ordinary cells. In the drawing given, you will see cells in different stages of growth.

At A is a cell just being converted into a queen-cell; at B, one where the thin walls are extended so as to form a queen-cell proper, almost ready to seal up. This occurs at just about 9 days from the time the egg was laid. In 7 days more, 16 days in all from the time the egg was laid, the queen will



QUEEN-CELLS, AFTER CHESHIRE.

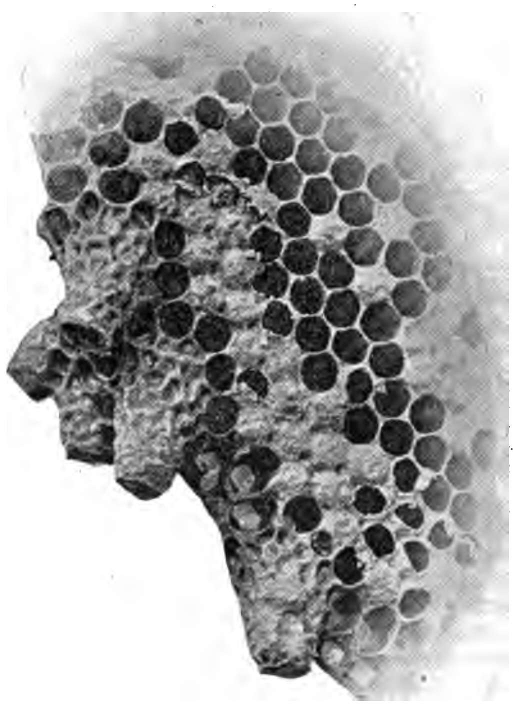
hatch out, a perfect insect. C is a cell just vacated. Now bear in mind exactly what I say, or you will get confused. If, instead of eggs, larvæ 3 days old are given the bees, they will rear a queen, and, in this case, she will hatch in only ten days after the larvæ were given them. These ten-day queens pr l

bly are not as good as those reared from younger larvæ; and I think, as a rule, it would be well to supersede them.

There are some queer things about queen-cells, as you will notice. After the cell is sealed, they go and put a great excess of wax on it, give it a long tapering point, and corrugate the sides something like a thimble, as shown at C. This corrugation, or roughness, when closely examined, will be seen to be honey-comb on a very small scale. Now right here is a point that you will not fail to observe: Bees, like other folks, sometimes make mistakes; for they do not seem to know any better than to use a drone-larva for rearing a queen, if such happens to be present.

Now, it is very handy to be able to tell about when any queen-cells you may happen to find unexpectedly will be likely to hatch; and the bees are very accommodating in this respect also; for, about the day before the queen hatches, or it may be two days, they go and tear down this long peak of wax on the tip of the cell, and leave only a very thin covering, similar to D. I do not know what this is for, unless it is because they are anxious to get a peep at their new mother. It has been said, they do it that she may be better able to pierce the capping; but sometimes they omit the proceeding entirely, and I have not been able to see that she has any difficulty in cutting the cap off. If the cell is built on new comb, or on a sheet of foundation, and it be held up before a strong light, at about the fifteenth day, or a little later, you will see the queen moving about in the cell. A little later, by listening carefully, you can hear her gnawing her way out. Pretty soon the points of her sharp and powerful mandibles will be seen protruding, as she bites out a narrow line. Since she turns her body in a circle while doing this, she cuts out a circle so true that it often looks as if cut out by a pair of compasses. Now observe, that the substance of which the cell is made is tough and leathery,[161] and, therefore, before she gets clear around her circle, the piece springs out in response to her pushing, and opens just about as the lid of a coffee-pot would if a kitten should happen to be inside crowding against the lid. I have often seen them push the door open and look out, with as much apparent curiosity as a child exhibits when it first creeps to the door on a summer morning: often, after taking this look, they will back down into their cradle, and stay some time. This is especially the case when other queens are hatching, and there is a strife as to who shall be sovereign.

We will now consider the strange substance royal jelly.



QUEEN-CELLS.

The milky food before described, which is given to the young larvæ, and which is supposed to be a mixture of pollen and honey partially digested, is very similar, if not identical, in composition with the royal jelly. The bees are not the only examples in the animal kingdom, where the food is taken into the stomach by the parent, and, after a partial digestion, is thrown up for the use of the offspring. Pigeons feed their young precisely in this way, until they are able to digest the food for themselves. It has

been stated that bees use a coarser food for the worker larvæ, after they are a few days old, and also for the drone larvæ, during the whole of their larval state. What I mean by a coarser food is, a food not so perfectly digested; in fact, drones are said to be fed on a mixture of pollen and honey, in a state nearly natural. This may be so, but I have no means of proving it to my satisfaction. It has also been said, that the queens receive the very finest, most perfectly digested, and concentrated food that they can prepare. This I can readily believe, for the royal jelly has a very rich taste—something between cream, quince jelly, and honey—with a slightly tart and a rank, strong, milky taste that is quite sickening if much of it be taken. See ROYAL JELLY, under the head of ANATOMY OF BEES.

WHAT DOES THE QUEEN DO WHILE SEALED UP?

Candidly, I do not know very much about it, although I have opened cells at every stage after they were sealed, until they were ready to hatch. One day after being sealed, they are simply ordinary larvæ, although rather larger than worker larvæ of the same age; after two or three days, a head begins gradually to be "mapped out," if that is the proper expression, and, later, some legs are seen folded up; last of all, a pair of delicate wings come from somewhere, I hardly know how. Two days before hatching I have taken them out of the cell, and had them mature into perfect queens, by simply keeping them in a warm place. I have also taken them out of the cell before they were mature, held the white, still, corpse-like form in my hand while I admired it as long as I chose, then put it back, waxed up the cell by warming a bit of wax in my fingers, and had it hatch out three days after, as nice a queen as any. Mr. Langstroth mentions having seen the whole operation by placing a thin glass tube, open at both ends, into the cell, so as to have it inclose the queen, the bees being allowed to cap it as usual. If I am correct, this experiment was first made by Huber. With several such glass queen-cells, I presume the whole operation could be watched from beginning to end.

DAVIS' TRANSPOSITION PROCESS.

In the month of August, 1874, after I had discovered how to send larvæ for queen-rearing safely by mail for short distances, our friend J. L. Davis, of Delhi, Ingham Co., Mich., wrote that he should get a large number of queens from the piece I sent him, for he was going to remove the larvæ from the cells and place them in queen-cells already started in his hives—of course, removing the original larvæ first. I caught at the idea at once, and went to some hives of hybrids that had persisted in tearing down all the cells given them, and building others from their own brood, and removed the larvæ from all the cells, substituting larvæ from the imported queen in its stead. I used a quill toothpick for making the transposition. Almost every cell was built out and capped, just as well as if they had kept their own black stock. In due time I had as nice a lot of fine yellow queens as I ever reared. We have practiced this method almost every year since.

We have used a tiny silver spoon, made on purpose for removing the larvæ, and as much of the milky food as possible.[161] I need hardly caution you that these small larvæ are very tender and delicate, and will hardly bear so much as a touch, without injury.

WHAT BECOMES OF THE QUEEN AFTER SHE LEAVES THE CELL?

I am glad to say that I can tell you, by personal observation, pretty nearly what a queen does after she pushes open that hinged door that I told you of, and which you will find illustrated under the head of QUEEN-REARING. She generally begins to put her head into the cells until she finds one containing unsealed honey, from which she takes a sup that, at least, indicates that she likes that kind of provision.

After she has had her supper she begins to crawl about, partly to enjoy using the long strong legs God has given her, and perhaps because she knows that it is her allotted task to tear down the remaining queen-cells, if such there are. If other queens have hatched before her, it is one of her first and foremost duties to look them up, and either reign supreme or die in the attempt.[543, 168] If all other cells have been removed, as they usually are where queens are wanted for other purposes, she has nothing to do but to promenade over the premises, monarch of all she surveys. If she ever sits down to take a rest, or takes a rest in any other position, during the first week of her life, I have never been able to discover it. She is always traveling about, and this is one reason why I am averse to caging young queens, in order that we may allow several to hatch in the same hive. It seems to be natural for them to run about, and I believe it is necessary for their well-being. Several

years ago I thought I had made a brilliant discovery when I succeeded in hatching all the queen-cells in the hive, under cups made of wire cloth. The first hatched was allowed to run until she became fertile, and began laying; she was then removed, and the next released, and so on. I think I succeeded in getting four laying queens from the single lot of cells, all in the one hive, but the bees made such desperate efforts to get the obnoxious cages out of the way, and the inmates of the cages to get out, that I gave up the plan, after seeing several fine queens die of nothing else, so far as I could see, than confinement.

But suppose she does find another cell; what then? Well, she sometimes runs around it awhile; sometimes the bees tear it down, and sometimes she tears it down herself, with the same strong mandibles that she used to cut her way out of the cell at first. She usually makes the opening in the side of the cell, as shown at E in cut on page 269.

Now, it is said that the queen immediately stings her helpless immature sister, to make a sure thing of her destruction; but of this I am not certain, for I never saw her in the act of so doing. I have seen spots in the side of the queen that looked much as if she had been stung, but I have also rescued cells and put them into a wire-cage nursery after they had been torn open, and had them mature into nice queens. As these immature queens are very soft, the workers will soon pick them out of the cell, piece by piece, and I have sometimes placed them in the nursery and had them mature, minus a wing or leg, or whatever portion the mischievous worker had pulled away. I judge from many such observations that the queen generally tears a hole in the cell, or bites into it in such a way that the workers take hold of it, and tear it all down, much in the way they do any mutilated or broken piece of comb.[163] When queen-cells have been cut out, all the larvæ that are in any way injured are at once thrown out, and none but the perfect cells preserved. Bees never fuss with cripples, or try to nurse up a bee that is wounded or maimed. They have just the same feeling for their fellows that a locomotive might be expected to have for a man whom it had run over. They battle against any thing that threatens the extinction of the colony, it is true; but I have never been able to discover any signs of their caring for one of their number, or even having compassion on their helpless brood, when it is wounded and suffering. If a hole is made in a queen-cell, by the queen or anybody else, they are almost sure to tear it down and throw it away. When a queen hatches, the remaining cells are very soon torn down, as a general thing, but there are many exceptions.[547] When two queens hatch out at about the same time, they also generally attempt to kill each other; but I have never heard of both being killed. This probably results from the fact that they can sting their rivals only in one certain way; and the one that, by strength or accident, gets the lucky position in the combat, is sure to come off victor. This explains how a very inferior virgin queen, that has got into the hive by accident, may sometimes supplant an old laying queen. Two queens, when thus thrown together, generally fight very soon, but this is not always the case. Several cases are on record where they have lived in peace and harmony for months, even when hatched at about the same time, and it is quite common to find a young queen helping her mother in the egg-laying duties of the hive, especially when the mother is two or three years old. If the season is good, and the hive populous, very often, instead of a fight, they divide up their forces in some way, and we have AFTER-SWARMING, which see.[164]

Sometimes the queen will pay no attention to the remaining cells,[549] but will let them hatch out, and then their "little differences" are adjusted afterward, either by swarming or by the usual "hand-to-hand" conflict "until death." I once looked for a queen, and, not finding her, concluded she was lost. Another cell was inserted, and in due time hatched out. I was much surprised to find my new queen laying when only one day old; but a little further looking revealed the two, both on the same comb. Many losses in introducing queens have resulted from two queens being in the hive, the owner being sure his hive was queenless—because he had removed one.

QUEENS' VOICES.

Queens have two kinds of voices, or calls, either one of which they may emit on certain occasions. It is almost impossible, on the printed page, to describe these sounds. One of these is a sort of z-e-ep, z-e-ep, zeep, zeep. Some call it piping, others teeting. Whatever it is, it consists of a prolonged tone, or, as we might say, a long zeep followed by several much shorter, each tone shorter than the preceding one. This piping is made when the queen is out of the cell, either a virgin or a laying, but

usually by a young one. The older ones are generally too dignified, or too something, to give forth any such loud squealing; but they will squeal, and lustily, too, sometimes, when the bees ball them and grab them by the legs and wings. They squeal just as we would when surrounded by enemies on every side, and in mere fright give a yell of alarm.

The other note that queen-bees are known to give forth is what is called *quahking*, for that more nearly describes the actual sound than any other combination of letters we can put together. If I mistake not, it is emitted only when the queen is in the cell, before she is hatched, and is made in answer to the piping or zeep, zeep, of one of the virgins that has already hatched, and is trying perhaps to proclaim aloud her sovereignty. The quahk will be heard, then, only when there are queen-cells in the hive. At other times the note will be a series of long z-e-ep, z-e-e-p, zeep, followed by shorter tones, as explained.

When a young queen is being introduced she will frequently utter a note of alarm, a zeep, zeep, etc., and some of our friends have called it "squealing." The bees are almost always stirred by these notes of the queen, and they will often turn and run after her and cling around her like a ball, when they would have paid no attention to her had she not uttered this well-known note. After you have once heard it, you will recognize it ever afterward. Queens, when placed near together in cages, will often call and answer each other, in tones that we have supposed might be challenges to mortal combat.

Some queens received one summer from W. P. Henderson, of Murfreesboro, Tenn., called so loudly, when placed on our table, that they could be heard clear across a long room. One voice would be on a high, shrill key, and another a deep bass, while others were intermediate. On watching closely, a tremulous movement of the wings was noticed while the queen was uttering the note, and one might infer from this that the sound is produced by the wings, but this is probably not the case. Some one, I think, reported having heard a queen squeal, both of whose wings had been entirely clipped off.[550] That these sounds from the queen have the power of controlling certain movements of the bees I am well aware, but I do not know just how or to what extent this influence works.

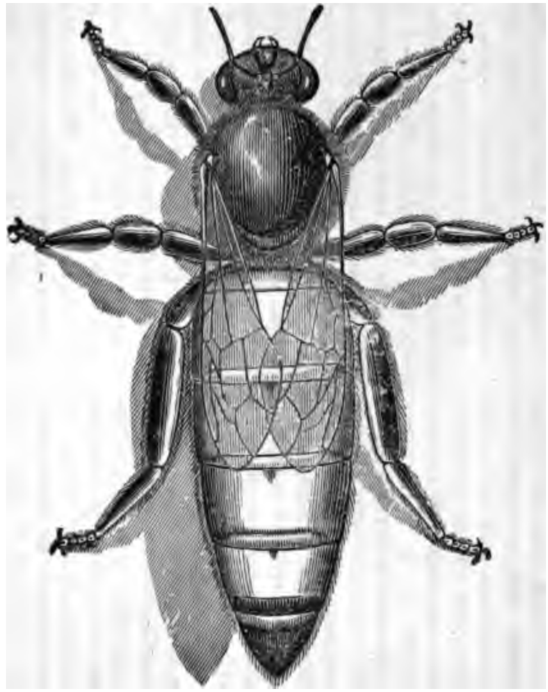
VIRGIN QUEENS.

The newly hatched queen is termed a virgin queen to distinguish her from queens that have been fertilized by the drone, and are laying. Virgin queens, when first hatched, are sometimes nearly as large as a fertile queen, but they gradually decrease in size; and when three or four days old they often look so small and insignificant that a novice is disgusted with their appearance, and, if he is hasty, pronounces them good for nothing. For the first week of their lives they crawl about much as an ordinary young worker does, and it is often very difficult, if not almost impossible, to find them, unless an amount of time is taken that is more than a busy apiarist can well afford to spare. In QUEEN-REARING I have advised not to look for them, but to insert a small piece of comb containing larvæ, and, if no cells are started, you can decide the queen is there, without looking. This piece of larvæ answers a threefold purpose. It tells at a glance whether the queen is in the hive all right or not; for the very moment she is lost, they will start more queen-cells on it; it enables the bees to start another queen, in case the queen is lost by any accident in her wedding-flight, which is frequently the case; and, lastly, it serves as a sort of nucleus to hold the bees together, and to keep them from going out with the queen on her wedding-trip, which they are much disposed to do, if in a small nucleus containing no brood. Unsealed brood in a hive is a great safeguard against accidents of all sorts, and I have often started a young queen to laying by simply giving the bees some eggs and unsealed brood. Whether it caused her to rouse up and take her wedding-flight, or whether she had taken it, but was for some reason idle, I can not say; but this I know, that young queens that do not lay at two weeks of age will often commence, when eggs and larvæ are given to their colonies. It may be that the sight of eggs and larvæ suggests to them the next step in affairs, or it may induce the workers to feed them, as they do a laying queen, an unusual quantity of food.

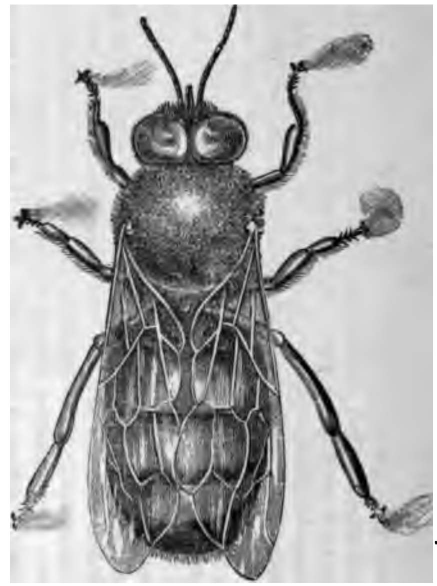
AGE AT WHICH VIRGIN QUEENS TAKE THEIR WEDDING-FLIGHT.

Our books seem to disagree considerably on this point, and I am afraid that many of the book-makers find it easier to copy from the sayings of others than to make practical experiments. It has been variously stated, at from two to ten days: some go as far as to say that the queen goes out to meet the drones the day after leaving the cell. It is quite likely that some difference arises from

WORKER.



QUEEN.



DRONE.

the fact that queens often stay in the cell a day or two after they are strong enough to walk about.* Sometimes a queen will be found walking about the combs when she is so young as to be almost white; I have often seen beginners rejoice at their beautiful yellow queens, saying that they were yellow all over, without a bit of black on them; but when looked at again, they would be found to be as dark as the generality of queens. At other times when they come out of the cell they will look, both in color and size, as if they might be three or four days old. The queens in our apiary generally begin to crawl about the entrance of the hive, possibly looking out now and then, when 5 or 6 days old. The next day, supposing of course we have fine weather, they will generally go out and try their wings a little. These flights are usually taken in the warmest part of the afternoon. I know of no prettier or more interesting sight to the apiarist than the first flight of a queen. Perhaps a few hours before he had looked at her, and been disappointed at her small and insignificant appearance; but now, as she ventures out cautiously on the alighting-board, with her wings slightly raised, her tapering body elongated and amazingly increased in size, he looks in wonder, scarcely believing she can be the same insect. She runs this way and that, something as does a young bee, only apparently much more excited at the prospect of soaring aloft in the soft summer air. Finally she tremblingly spreads those long silky wings, and with a graceful movement that I can not remember to have seen equaled anywhere in the whole scope of animated nature, she swings from her feet, while her long body sways pendulously as she hovers about the entrance of the hive.

A worker-bee hovers about the entrance and carefully takes its points when it tries its wings for the first time; but she, seeming to feel instinctively that she is of more value to the colony than many, many workers, with the most scrupulous exactness notes every minute point and feature of the exterior of her abode, often alighting and taking wing again and again, to make sure she knows all about it. I remember that, when I saw one for the first time go through with all these manœuvres, I became impatient of so much manœuvring, and if I did not say, I felt like saying,—

"There! there! young lady; you certainly know where you live now; do you suppose a fellow can stay here all the afternoon, neglecting his business, just to see you start off on your first journey in life?"

By and by she ventures to circle a little way from home, always bringing back soon, but being gone longer and longer each time. She sometimes goes back into the hive satisfied, without going out of sight at all; but in this case she will be sure to take a longer flight next day or a half-hour later in the same day. During these seasons she seems to be so intent on the idea she has in her little head that she forgets all about surrounding things, and, instead of being frightened as usual at your opening the hive, she will pay no attention to you; but if you lift up the comb she is on she will take her flight from that as well as from anywhere else. I have caught them in my hand at such times, without their being frightened at all; but as soon as they were allowed to go, they were off as if nothing had happened. After she is satisfied that she will know the place, she ventures out boldly; and from the fact of her circling right up in the air, we have, until lately, supposed that fertilization took place above the ken of human eyesight. This has been shown to be a mistake.

After a successful flight, she returns with the organs of the drone remaining attached to her body. See DRONES. This is a white substance, and is frequently so large as to be plainly seen while she is on the wing. I should think a queen is usually gone half an hour, but I have seen them return fertilized after an absence of not more than 10 or 15 minutes. This accomplished, she goes quietly into the hive. The bees are much inclined to chase after her, and they sometimes pull at the protruding substance as if they would drag it away, but I am inclined to think it is eventually absorbed into the body of the queen. In looking at her the day after, all the trace of it you will observe will be possibly a shriveled thread. In one day more you will, as a general rule, find her depositing eggs. I presume the average age at which our queens are laying is about 9 days; we generally wait 10 days from the date of hatching, and are then pretty sure of finding them ready to send off. Between the fertilization and the time the first egg is laid a remarkable change takes place. After the queen has been out and fertilized, her appearance is much the same as before. She runs and hides when the hive is opened, and looks so small and insignificant, one would not think of calling her a fertile queen. A few hours before the first

* Recent reports state that queens were confined in cells 4 or 5 days after they should have hatched.

is laid, however, her body increases remarkably in size, and, if an Italian, becomes lighter in color, and, instead of running about as before, she walks slowly and sedately, and seems to have given up all her youthful freaks, and come down to the sober business of life, in supplying the cells with eggs.

HOW OLD A QUEEN MAY BE AND STILL BECOME FERTILIZED.

As I have said before, our queens usually begin to lay when 8 or 10 days old, on the average; but during a dearth of pasturage, or when drones are scarce, they may fail to lay until three weeks old. The longest period I have ever known to elapse between the birth of a queen and laying, when she produced worker-eggs, was 25 days. I think I would destroy all queens that do not lay at the age of 20 days, if the season, flow of honey, flight of drones, etc., is all right. There is one important exception to this. Many times queens will not lay in the fall at all, unless a flow of honey is produced either by natural or artificial means. Queens introduced in the fall will often not lay at all until the ensuing spring, unless the colony is fed regularly every day for a week or ten days. Also young queens that are fertilized late in the season will often show no indications of being fertilized until the colony is fed as I have indicated. A lot of young queens that I thought might be fertilized but did not lay, I once wintered over, just to try the experiment; and although they went into winter quarters looking very small, like virgin queens, they nearly all proved fine layers in the spring.

DRONE-LAYING QUEENS.

If a queen is not fertilized in two weeks from the time she is hatched, she will often commence laying without being fertilized at all. She is then what we call a drone-laying queen. Usually her eggs are not deposited in the regular order of a fertile queen, neither are there as many of them; but by these marks we are able only to guess that she may not be all right, and so keep her until some of the brood is capped, when the extra height of the cappings, as I have explained under DRONES, will tell the story. At times, however, the eggs are deposited so regularly that we are deceived, and the queen may be sold for a fertile queen, when she is only a worthless drone-layer; but we always discover it after the brood is capped, and send our customer another queen. Such a case occurs, perhaps, once in a thousand. Whether these drone-layers are just as good to furnish supplies of drones for the apiary as the drones reared from a fertile queen, is a point, I believe, not fully decided; but if you care for my opinion, I should say if the queen lays the eggs in drone comb, and the drones are large, fine, and healthy, I believe them to be just as good. I should not want to use drones reared from fertile workers, or drones reared in worker-cells, as those from drone-laying queens sometimes are.

SHALL WE CLIP QUEENS' WINGS?

The majority of honey-producers practice what is known as clipping; that is, two wings on one side are cropped off, leaving merely the stumps of what were once wings. The object, of course, is to prevent swarms from going off by making it impossible for the queen to follow.

As soon as a swarm issues it will, of course, circle about in the air for a few minutes, when, discovering the absence of the queen, it will return to the old hive, where it will find her, probably, hopping about near the entrance. If the apiarist happens to be on hand he changes hives while the bees are in the air, and when they return they enter their new quarters with the queen. See SWARMING. If he is not present, or any one else to take care of them, no harm is done, for the bees with the queen simply go back.

If one does not practice clipping he is quite sure to be bothered with swarms clustering in difficult and inaccessible places, swarms going off, to say nothing of the general annoyance to neighbors and to himself in recovering and finally bringing back his absconders.

Some, instead of clipping, prefer to use entrance-guards or Alley traps (see DRONES). They prevent all possibility of any valuable queens getting lost in the grass, and save the marring of her symmetrical appearance. But outside of any sentimental reason, if we may call it such, the use of entrance-guards often saves an hour or two of hunting for the queen (for the purpose of clipping), especially if the bees are black or hybrid, or the colony is very populous. It takes but a moment to put on the entrance-guards, and it may, perhaps, on an average take five or ten minutes to find a queen and clip her wings, taking colonies as they run.

But entrance-guards are objected to because they obstruct more or less the passage of the bees to and from the hive; and this, in the height of the season, it is argued, cuts down somewhat the actual amount of honey secured. I hardly think there is much in

this; and still I am willing to admit that it may possibly make an appreciable difference.

There are very few who believe or profess to believe that clipping is injurious to the queen. The fact that queens after being clipped seem to do good service for two or three years, and sometimes four, and the further fact that such queens do as well as those not clipped, would seem to show that no detrimental results follow.

HOW TO CLIP QUEENS' WINGS.

There are several ways of accomplishing this. One way is to grasp the queen by the wings with the right hand, in the usual manner. Now, with the thumb and forefinger of the left hand, take hold of her waist, or thorax. In this way she can be held very securely and safely, leaving her legs as well as her wings free. With a pair of slender-pointed embroidery scissors (or any kind of scissors if these are not obtainable) clip off the *two wings* on one side, leaving anywhere from $\frac{1}{8}$ to $\frac{1}{16}$ of an inch, and being careful not to cut too close. This accomplished, drop her gently between two frames of brood; but in no case let her fall more than an inch; for a queen during the height of the egg-laying season is liable to be injured if handled roughly.

HOW TO CLIP A QUEEN'S WINGS WITH A DULL POCKET-KNIFE.

Sometimes in an out-yard, when a pair of scissors is not to be had, I use the sharp blade of a penknife. This is passed under the two wings in such a way as to cause them to bear directly upon the edge of the blade. The thumb is now pressed down upon the wings over the blade, and then drawn back and forth seesaw fashion, perhaps two or three times. If the knife is sharp, the wings will be severed with two or three strokes. If it is dull, the queen should be laid on her back, still holding her between the thumb and finger of the left hand so that her wings will bear directly upon a hive-cover or any other piece of board or wood. The edge of the knife should be brought to bear upon the wings. A slight pressure will cause the blade to pass through the wings into the cover.

During these operations be careful to handle queens only by the wings or by the thorax. There is no danger of hurting her in the least when she is handled in this way, providing you are not *too* clumsy. But always be careful about pressing the abdomen of the queen.

There are some beginners who perhaps feel some hesitancy about picking up any thing so delicate as a queen-bee for fear they may

injure her in some way. For such there has been devised a little instrument called the Monette queen-clipping device.* It consists of a sort of spiral cage made of coiled wire. It is large at the bottom and small at the top. This is placed over the queen; finding herself confined she will run toward the top. A piece of tin is then slipped back of her so that she is confined in a space equal to her own length and diameter. A pair of scissors passes between the wires of the spirals at the right point, and clips the wings. The device is then set back on the comb, and the queen is allowed to go back to her usual tramping-ground without so much as the finger of a human being having touched her. For further particulars on clipping see SWARMING.

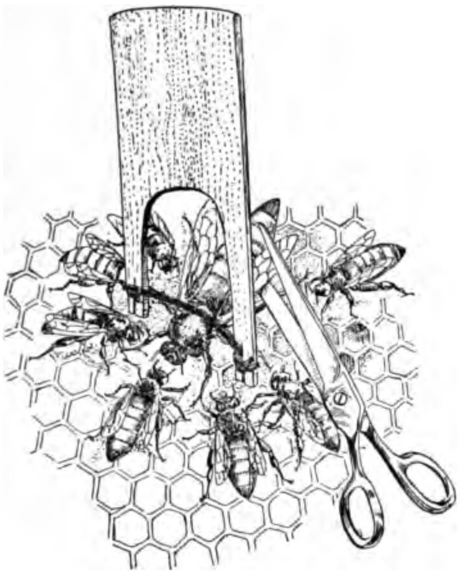
Another very simple divice, and something any one can make, is shown in the illustration on next page. It consists of a piece of section stuff $\frac{1}{8}$ inch thick, whittled out as shown. The two ends of the prong are split, and a light rubber band is secured in the manner indicated.

This band must be stretched just tight enough so that, when the implement straddles a bee, the rubber band will hold it securely. For the purpose of determining just when the right amount of tension is secured, one should try it on common bees as they walk across on the combs. If it fails to hold one of them, the band should be stretched a little tighter; and if not then sufficient, a heavier band should be used. After having tried it on ordinary bees, one

*The cut was loaned to us by the publishers of the *American Bee Journal*.

can then use it on a queen-bee, and clip her wings in the manner shown.

This is the invention of Mr. R. D. Willis, of Montrose, Col.; and after having tested the same we find that the implement works very satisfactorily.



WILLIS QUEEN-CLIPPING DEVICE, AND HOW USED.

Handling queens in the fingers sometimes gives them a scent that will induce the bees to ball them after they have been clipped. This little device would obviate any trouble of that kind.

HOW QUEENS LAY TWO KINDS OF EGGS.

That they do lay two kinds of eggs I think few are inclined to dispute, since the experiments with the microscope have decided the matter so clearly, as given under DRONES. Suppose a young queen goes out to meet the drones so late in the fall or so early in the spring that there are none; what is the consequence? Well, sometimes she will never lay at all; but frequently she commences to lay when 3 or 4 weeks old, and her eggs produce only drones. In fact, she can produce no other eggs, having never been fertilized. How shall we distinguish such queens from fertile ones? We can not decide positively concerning them, by any means that I know of, until their brood is ready to seal up; then we will know by the round, raised caps of the brood, like bullets laid on a board, as I explained under DRONES. We can give a pretty good guess, by noticing the way in which she lays the eggs; if they are few and scattering, and sometimes, or often, in drone-cells, coupled with the fact that she did not commence laying until two weeks or more old, we had better not send her off as a dollar queen, until some of her brood is sealed over. A young queen, if properly fertilized, never, or very rarely, lays an egg in a drone-cell; and when she commences to lay, she fills cell after cell in regular order, as men hoe a field of corn; her work also has a neat and finished appearance that says at once to the practiced eye, "You are all right."

Now, my friends, do not think me contradictory when I tell you that a young queen in rare cases commences with all, or nearly all, drone-eggs, and, after awhile, lays entirely worker-eggs as regularly as one might wish. I do not know why this is: perhaps she has not yet got used to the "machinery." Once more, you must bear with me when I tell you that any queen, the best one you ever saw, is liable, at any day of her life, to commence, on a sudden, laying drone-eggs altogether, or only in part. I wish you to remember this, that you may be more charitable toward each other in your dealings. A nice laying young queen, taken from a hive, and shipped to a distance, may prove to be a drone-layer shortly after, or immediately after, she is received. Such things are not very common, but they do occur. In an apiary of 50 or 100 hives I should expect to find one drone-layer, on an average, each spring. During the summer, perhaps one more will be found. It may be that the queen was not fertilized sufficiently, if I may use the term, and that the supply of spermatozoa gave out while she was in full vigor, thus reducing her to the condition of a virgin queen. Microscopic examination has shown an entire absence of spermatozoa in at least one or two instances, where queens of this kind were killed and dissected. Similar experiments, given by Langstroth, show that the spermatozoa may be chilled beyond recovery, by chilling the queen, and yet the queen herself may be resuscitated. I think it likely that hardship and being shipped long distances may produce the same results. Do not think I am going to excuse those who sell queens, and let the blame for unprofitable queens slip off their shoulders; on the contrary, I think they had better make up their minds to render a full equivalent for all the money they receive. If a queen proves a drone-layer before the purchaser can receive any benefit from her, I think another should be sent.

Of course, I can not give a rule for settling all such matters, but I would most earnestly advise that we all try to do as we would be done by, and be each one *ready* to bear a little more than our share of such losses as may come up.

Well, queens not only turn suddenly to drone-layers, but they sometimes produce about an equal number of each kind of eggs. In all these cases, where the queen lays drone-eggs when she evidently intended to lay worker-eggs, they are in worker-cells; also the number of eggs laid usually rapidly decreases. The bees, as well as queen, evidently begin to think that something is wrong; queen-cells are soon started, and after the young queen is hatched she becomes fertile, and begins to help her mother. All hands evidently think that any kind of a queen is better than no queen, hence a queen is seldom dragged out of the hive, as a worker-bee is, because she is ailing.

Very early in the spring, or late in the fall, or at any time when forage is not abundant, a queen will pass right by drone-cells, taking no notice of them. I have often tried to get eggs in drone-cells by feeding, and can but conclude that the queen knows when an egg will produce a drone, and knows just what "wires to pull" to have every egg laid in a drone-cell produce a drone. I think it very likely the workers have something to do with this matter, but I have never been able to make out by what means they signify to the queen that some eggs in drone-cells, or even queen-cells, would be desirable. There seems to be a constant understanding in the hive as to what is going to be done next, and consequently there is no clashing. I wish, my friends, the human family could understand each other as well. In our apiary there seems to be, in strong stocks, a kind of understanding that eggs shall be laid in drone-cells about the last of March, and we have drones, therefore, some time in April, ready for the first queens that may, by any accident, make their appearance. Those who insist that there is only one kind of eggs can satisfy themselves easily, by cutting out a piece of comb, eggs and all, from either a drone or worker cell, and setting it in the bottom of a cell of the other kind. They will get a drone in a worker-cell, or a worker in a drone-cell. Again: If you give a young laying queen a hive supplied only with drone-combs, she will rear worker-brood in these drone-cells. The mouth of the cells will be contracted with wax, as mentioned in HONEY-COMB.

When they get ready to swarm they build shallow queen-cells, and the queen then lays a worker-egg in these queen-cells. Although I never saw her lay an egg in a queen-cell, I am satisfied that she does it, from the way in which it is put in. Like the rest of the eggs, it is fastened to the center of the bottom of the cell by one of its ends, and I suppose, when first deposited, it is covered with a sort of glutinous matter that makes it stick firmly, where it first touches. I know that bees have the skill to remove both eggs and larvæ, for I have several times known of their taking eggs and brood to an old dry comb, when no queen was present in the hive. Occasionally a queen is found that will never lay at all; again, queens that laid eggs which never hatched into larvæ have been several times reported. We have had several such, and they were in appearance fine nice-looking queens.

After having told you thus much of the faults and imperfections of queens, I would add, for their credit, that when once properly installed in a strong colony they are about as safe property as any thing I know of, for, in the great majority of cases, they live and thrive for years. I have never heard of any disease among queens, and, while a worker lives only a few months, they often live 3 or 4 years. One that was imported from Italy by Dadant furnished us brood and eggs for queen-rearing for four summers. I then sold her for $2.00, and she died in being sent less than 50 miles. She was very large and heavy, and, probably, being so old could not cling to the sides of the cage like a younger one.[553] I have never heard of queens being troubled with any thing but an Italian parasite, and these quickly disappeared when they were introduced into our own apiaries. See ENEMIES OF BEES.

LOSS OF QUEEN.

It is a very important matter to be able to know at once when a queen is lost. During the months of May and June the loss of a queen from the hive a single day will make quite a marked difference in the honey-crop. If we assume the number of eggs a queen may lay in a day to be 3000, by taking her away a single day we should, in the course of events, be just that number of bees short, right during a yield of honey. To put it very moderately, a quart of bees might be taken out of the hive by simply caging the queen for a single day. Beginners should remember this, for their untimely, or, rather, inconsiderate tinkering, just before the flow of honey comes, often cuts short their in-

come to a very considerable degree. Whatever you do, be very careful you do not drop the queens off the combs when handling them at this time of the year, and do not needlessly interrupt the queen in her work by changing the combs about so as to expose the brood or upset their little household matters in the hive. With a little practice you will be able to detect a queenless hive, simply by the way the bees behave themselves on the outside. Where they stand around on the alighting-board in a listless sort of way, with no bees going in with pollen, when other colonies are thus engaged, it is well to open the hive and take a look at them. If you find eggs and worker-brood, you may be sure a queen is there; but if you do not, proceed at once to see if there is not a queen of some kind in the hive, that does not lay. If you do not find one, proceed at once to give them a frame containing brood and eggs, and see if they start queen-cells. You ought to be able to find incipient queen-cells in about 12 hours, if the bees have been some little time queenless. As soon as you see these, give them a queen if possible. If no queen is to be had, they may be allowed to raise one, if the colony has bees enough. If it has not, they had better be united with some other stock.

ODOR OF A LAYING QUEEN.

After bees have been some time queenless, they usually become, if no fertile workers make their appearance (see FERTILE WORKERS), very eager for the presence of a queen; and I can in no way describe this eager behavior, if I may so term it, so well as to describe another way of testing a colony you have reason to suspect is queenless. Take a cage or box containing a laying queen, and hold either the cage, or simply the cover of it, over the bees, or hold it in such a way as to let one corner touch the frames. If queenless, the first that catch the scent of the piece of wood on which the queen has clustered will begin to move their wings in token of rejoicing, and soon you will have nearly the whole swarm hanging to the cage or cover. When they behave in this manner I have never had any trouble in letting the queen right out at once. Such cases are generally where a colony is found without brood in the spring.

There is something very peculiar about the scent of a laying queen. After having had a queen in my fingers, I have had bees follow me and gather about my hand, even when I had gone some distance from the apiary. By this strange instinct they will often hover about the spot where the queen has alighted even for an instant, for hours, and, sometimes, for a day or two afterward. Where clipped queens get down into the grass or weeds, or crawl sometimes a considerable distance from the hive, I have often found them, by watching the bees that were crawling about, along the path she had taken. When cages containing queens are being carried away, bees will often come and alight on the cage, making that peculiar shaking of the wings, which indicates their joy at finding the queen.

QUEENS' STINGS.

There is something very strange in the fact that a queen very rarely uses her sting, even under the greatest provocation possible, unless it is toward a rival queen. In fact, they may be pinched, or pulled limb from limb, without even showing any symptoms of protruding the sting at all; but as soon as you put them in a cage, or under a tumbler with another queen, the fatal sting is almost sure to be used at once.[555] There seems to be a most wise provision in this; for if the queen used her sting at every provocation as does the worker, the prosperity of the colony would be almost constantly endangered. It is true, that instances are on record where queens have stung the fingers of those handling them; but these cases are so very rare it is quite safe to say queens never sting. I am inclined to think the cases mentioned (although, of course, it must be only a surmise) were with queens that were not fully developed; for I have often seen the dark half-queen and half-worker, mentioned some time back, show its sting when handled as we usually handle queens. It is said that a queen has been known to lay eggs after having lost her sting; but as they never lose their stings, so far as I know, at least, when they sting rival queens, we must consider this as a very unusual occurrence. When you wish to pick queens from a comb, you can do it with just as much assurance of safety as if you were picking up a drone. It is true, the queen often bites with her powerful mandibles, and she does this so viciously that a novice might be almost excusable for letting her get away in affright.

CAUTION IN REGARD TO DECIDING A STOCK TO BE QUEENLESS.

As a rule, we may say that absence of brood or eggs is a pretty sure indication of queenlessness; but it should be borne in mind that all hives, as a rule, are without eggs and brood in the fall and early winter

months, or, in fact, at any time when there is a considerable dearth of pasturage. At such seasons, beginners are more apt to think their hives are queenless, because the queens are much smaller than when they are laying profusely. In weak colonies queens often cease laying during the whole of the winter months. See INTRODUCING.

REARING QUEENS BY THE DOOLITTLE METHOD.

R.

RAPE (*Brassica*). This plant is a near relative of the turnip, cabbage, mustard, etc. All of them yield honey largely, where grown in sufficient quantities. As rape is the only one of which the seed is utilized for purposes other than for increase, it should play a prominent part on the honey-farm. It would seem, in fact, that it is almost the only plant that should stand beside BUCKWHEAT, or rather, perhaps, above it, for the honey from the rape is very much superior to buckwheat honey. The great drawback is the lack of hardiness of the young plants, when they first come up. In our locality the black flea is almost sure to eat the tender green leaves when they first make their appearance. Our neighbors have several times tried considerable fields of it; but though it would come up nicely, this flea would take off almost every plant. In other localities we have had reports of bountiful crops of seed, and honey enough so that the bees worked beautifully in the surplus receptacles. Like buckwheat, it commences to blossom when quite small, and continues in bloom until the plant has gained its full height. As it will bloom in 20 days after sowing, it may be sown almost any time in the summer; and it is said to escape the ravages of the flea best when sown late. We have had it yield *honey* finely when sown the first of August. The ground should be very finely pulverized, for the seeds are very small. It is sown broadcast, three pounds of seed to the acre. There is a steady and good demand for the seed, for feeding canary birds, as well as for the manufacture of oil. Bee-keepers should contrive to induce seedsmen to have all these seeds raised near them, or on their own grounds. Dealers in bird-seed should also be furnished in the same way, for these things are often raised in large quantities, where there are few, if any, bees to gather the honey. From what I have said on POLLEN, you will understand that both parties would be benefited by the arrangement.

RASPBERRY. Where this fruit is raised largely for the market it is quite an important honey-plant; but it would hardly be advisable to think of raising it for honey alone. The bees work on it closely in our locality, and its quality is of the very finest. If bee-keepers and growers of small fruits could locate near each other it would probably be a benefit to both. Langstroth says of the raspberry honey: "In flavor it is superior to that from white clover, while its delicate comb almost melts in the mouth. When it is in blossom, bees hold even white clover in light esteem.[559] Its drooping blossoms protect the honey from moisture, and they work upon it when the weather is so wet they can obtain nothing from the upright blossoms of the white clover."

In our locality it comes in bloom just after fruit blossoms, and just before clover, so that large fields of it are a great acquisition indeed. The red varieties (especially the Cuthbert) are said to furnish most honey.

RECORD-KEEPING OF HIVES. Almost every apiarist has a plan of his own, whereby he can record the condition of the hive at the time of the examination, so that, in future, without depending on memory, he may tell at a glance what its condition was when last examined. There are several good systems, but I will describe only two or three of the best.

Many of the large honey-producers, Dr. Miller among them, have what they call a "record-book." This book has a page for each colony, the number of the page corresponding with the number of the colony. The book should be small and compact, just about right to carry in the hip-pocket, and securely bound. It should always be carried when at work among the bees. On each page is supposed to be a record of each colony's doings within a year—when it became queenless, when it had cells or brood, when it swarmed, and, toward winter, strength and quantity of stores it had when

last examined. The page may contain a very few memoranda, but nothing else should be put on that page.

There is an advantage in the book method—that is, the book can be consulted in the house, and the work can be mapped out beforehand for the day. If the record-book be for an out-apiary, the work can be planned while riding to the yard; and upon arrival, the plans formulated can be executed. We will know in advance just where we are going to get cells to give to queenless colonies; just what colonies will be likely to have laying queens; what ones may cast swarms, and what ones will be likely to need more room in the way of sections or surplus combs. There is an objection to the record-book, however. It is liable to be lost, or to be left out in the rain; and if the book is lost, the whole knowledge of the apiary, except so far as the apiarist can remember, is gone. Another thing, only one can use the book at a time. If there are two in the yard this will sometimes be quite an inconvenience.

RECORD-KEEPING WITH SLATE TABLETS. The plan we prefer is to attach the record right on the hive itself, or, what is better, to a slate* belonging to the hive. These are made expressly for the purpose, and cost only $1.25 per 100, and they are large enough, if the records are abbreviated, to give the history of the colony for a year. Still further, the position that these slates occupy on the cover or on the side of the hive indicates at a distance the general condition of the colony, without so much as even reading the record on the slate. These slates are 2¾ by 1¾ inches, and they have a hole punched near one end, so as to admit of their being hung on the side of the hive. The accompanying cut shows one of these little slates. For writing the records, a slate-pencil, a common lead-pencil, or a red lead-pencil, may be used. The slate-pencil marks wash out a little too easily by the rain, so we prefer, as a general thing, a lead-pencil, which does not erase, except when the slate is rubbed with moistened fingers. By tilting it a little to the light, the marks show quite plainly.

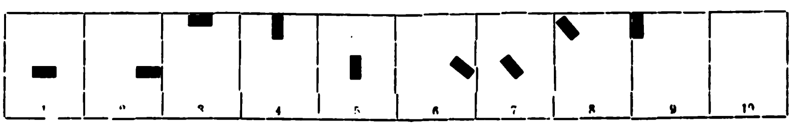
In the slate above I have given an example of the records we put on. Perhaps it may not appear very intelligible to the reader. Cell 6/19 means that, on the 19th of June, a cell from a best imported was given. "Ht 22" means that the queen hatched on the 22d of that month. July 2d she was laying, and August 15th she was found to be a pure tested Italian queen. A large 9 inscribed over the whole will be noticed. This means that, on the 9th of September, the queen was sold. The accompanying cut illustrates still another record, which, interpreted, signifies that, on the 18th of June, a best imported queen was caged. On the 20th she was out and laying; and on the 10th of the following month she was sold.

Every apiarist can formulate a system of short longhand that will be intelligible to himself and workmen. It takes too much time to write the whole history of the affair, so it is better to use a system of abbreviations; and, besides, it saves room.

In order to economize time in running up to a slate to see what it says, it is desirable to indicate, so far as possible, the last record on the slate by its position on the cover.

The accompanying diagram shows a few of the positions that may be used; and this number may be extended indefinitely by putting the slate cornerwise, endwise, etc., in the different positions shown. But it is desirable not to have too many, or else you or your help will be confused.

The code above is one we use in our apiary, and it is one that can be used in most yards. To make it really valuable, it will be necessary to memorize the meaning of



POSITION OF SLATE TO INDICATE THE CONDITION OF THE COLONY.

1. Queenless; 2. Cell; 3. Hatched virgin; 4. Laying queen; 5. Tested queen; 6 Caged queen to be introduced; 7 Caged queen out; 8. Something wrong; 9. Hive needs supers and more room; 10. No slate—hive with empty combs, ready for a swarm.

* A good many use, instead of a slate, pieces of sections, which are about the size. A tack pierces the strip into the hive-cover to keep it from blowing away. This can be used in the same manner as the slate; moreover, they are cheap (every bee-keeper has hundreds of them), and are easy to write on.

each position. In the diagram given, 10 positions are shown; and these have been proved by actual practice to answer our requirements. To aid the memory we will make use of a simple analogy. We have heard about cross-grained people—people who are always out of sorts, and with whom something is always wrong. For convenience we will call a colony not in its normal condition, "cross-grained." A colony that is queenless is apt to be crosser than one having a queen. Such a colony, as a rule, never does as well as one that has a queen. It is true, also, to a lesser extent, that a colony having a virgin queen is not doing as well as one having one that is laying. Well, now we start with No. 1, in the diagram as above. The slate is put *across* the *grain*, in the center of the hive. This means that it is queenless. No. 2, the slate is still across the grain, but near the *edge* of the hive; but this one has a cell. No. 3, the cell is hatched, and has a virgin queen; but as the colony has not yet reached its normal condition, the slate is still laid across the grain at the *end* of the cover. In eight or ten days, if all goes well, the virgin will be laying, and then we turn the slate *parallel* with the grain, as shown at 4. If the virgin queen should be lost, the slate is put back as shown in No. 1—across the grain. But we will suppose that our queen is laying, and in a month's time she proves to be tested, and an Italian. The condition of the colony has improved, as regards the value of the queen, so the slate is moved to the center of the hive, parallel with the grain.

So far the first five positions would cover the time of queen-rearing. But suppose we wish to introduce a queen—how shall we indicate it? The colony with a caged queen is neither queenless nor is it possessed of a queen, because they may take a notion to kill her as soon as she is released. To carry out the figure, the colony is about half way between the normal and abnormal condition. So we turn the slate to a diagonal. Position 6 means that the colony has just had a queen caged. No. 7 means that, a day or two afterward, she was found to be out. A few days later, if she is laying, the slate is put in position 4. But, suppose she is missing. Then the slate is turned in the position of 8. In general, position 8 signifies that there is something radically wrong with the colony. It may mean that it has a fertile worker, or that it is very short of stores, and will require to be fed at once.

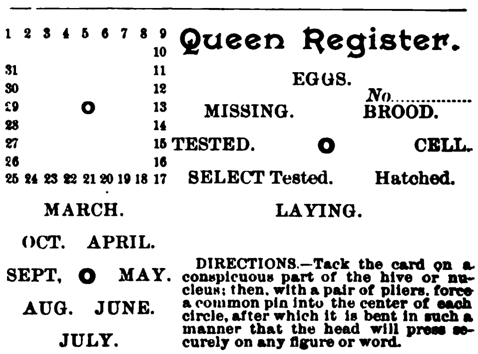
We have so far covered the history of a colony as touching the rearing and introducing of queens. When honey is coming in, it is desirable to know by the slates which ones will be likely to need supers soon. In 9, again, the slate is parallel with the cover. This means that it is overflowing with bees and honey, and will need, in a day or two, if not immediately, more room in the shape of sections or surplus combs. No. 10, without any slate on the hive, means that the hive in question is empty, having only frames of foundation or empty comb, and is, therefore, ready for the reception of a swarm.

One great feature of having slates on the top of the hive to indicate its condition is that, just as soon as we go out into the apiary, we can single out colonies that need attention first; and that, too, without hunting for them. For instance, to-day, June 19, I noticed that the bees were hanging out of a large chaff hive. "I wonder whether they will swarm," I thought. The hive was perhaps thirty yards from where I stood. Glancing at the top of the hive, the slate across the grain, on the edge of the cover, showed that the colony had only a queen-cell, and there was not much danger that it would cast a swarm that day. By standing upon one of our hives I can read the condition of every colony in our apiary of some 450 queen-rearing colonies, and that without moving a step.

Some bee-keepers, instead of using slate tablets, write with a lead-pencil on the top of the cover; then as the cover is to be painted about every two years, the records are obliterated, and new ones are started.

QUEEN-REGISTER CARDS.

Another system of record-keeping that is popular with some is what are called register-cards. The accompanying plan shows



how they are used. To indicate the date, the pin-points are revolved so as to point to

the proper place. There is no writing, and nothing to do except to turn the pointers to the right place. This is preferred by W. Z. Hutchinson and others.[563]

REVERSING. This, as the term signifies, is the process of inverting, or turning over, the combs; and this may be accomplished by inverting individually the several frames or the whole hive at one operation. The subject began to be discussed in 1884; and for three or four years following there was much said on the subject. Reversible frames and reversible hives were invented by the dozen. Some of them were quite ingenious, and others were clumsy and impractical.

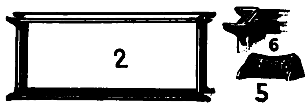
Taking into consideration the fact that the bees store their honey just immediately over the brood, and, as a consequence, their combs at this point would be much better filled out, certain bee-keepers conceived the idea of turning the combs upside down at certain intervals. "Why," said they, "when the combs are reversed, and the bottom-bars are uppermost, the combs will be built clear out to the bottom-bars, and the honey now in the bottom of the combs will be carried up into the supers, just where it is wanted." This seemed to be very nice in theory, and in practice it seemed to be partially carried out; for a good many bee-keepers reported that, when the combs were reversed, the bees, rather than have the honey in the bottom of the combs, near the entrance, and accessible to robbers, would uncap it and take it up into the sections. But the result was, that often poor and dark honey went up above; but more often, I believe, the bees allowed the honey to stay in the bottom of the hive, and the only real advantage secured was getting the combs filled clear up to the bottom-bars, then at the top.

A very few claimed that reversing, when done at the proper time, would destroy queen-cells, and that destroying queen-cells would control swarming. But it did not destroy—at least it never did in *our* case.

After all, the real and direct advantage of reversing is in the matter of getting combs filled out in brood-frames as solid as a board. In hunting queens it is much easier to find one when there is no horizontal space between the bottom of the comb and the bottom-bar, and no holes through which she can hide. Then, of course, having combs filled out solid gives a better fastening to the frame and increases the capacity of the hive, just in proportion as there is more comb after reversing than before. Nearly every frame that is not reversed is liable to have a space of ½ inch or ⅜; and this is certainly a waste of space that ought to be utilized if possible. To a certain extent this space can be filled in non-reversing frames by having sheets of foundation reach from bottom-board to top-bar, and wired in with perpendicular wires, but such combs do not begin to be as well filled as those reversed.

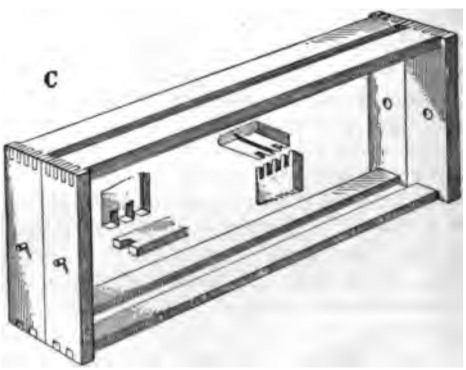
There were several good reversible frames that were proposed; but I would never think of adopting any one of them unless it should have some points of merit outside of the one exclusive feature of reversing. A reversible frame that is not a good one for all-around use would be very unprofitable.

One of the first practical reversing frames was the Van Deusen, having metal corners or ears. This is essentially a standing frame,



THE VAN DEUSEN REVERSIBLE FRAME.

and can be used just as well one side up as the other. The frames are spaced apart by the spacing-ears, and these very ears offer some distinctive advantages in the way of handling the frame. This frame is used very largely by perhaps the most extensive bee-keeper in the world, Capt. J. E. Hetherington (see biographies); also by his brother in Michigan, and outside of its reversing feature it offers one very decided advantage; namely, the facility with which it can be handled, about as the leaves of a book By taking out one or two frames the rest can be thumbed over without lifting them out of the hive.



DANZENBAKER'S REVERSIBLE FRAME.

Two other very excellent reversible frames are the Danzenbaker and the Heddon (see HIVES), either one of which can be used as

well one side up as the other; in fact, any closed end standing frame can be used as a reversible frame. Where one can get the advantage of reversing without its costing any thing, it is certainly advisable to reverse the frames at least once in order to get the combs completely filled out.

ROBBING. Paul says, "The *love* of money is the root of all evil." I should be inclined to state it in this way: The disposition to get money without rendering an equivalent is the root of all evil. Well, the root of a great many evils in bee-keeping is the disposition of the bees to gain honey without rendering any equivalent. Some one of our A B C class has said that he found bees making visits to over 100 clover-heads before they obtained a load sufficient to carry to their hives. I think it very likely, that during a great part of the season a bee will be absent a full hour, or, it may be, during unfavorable spells, as much as two hours, in obtaining a single load. Is it at all strange that a bee, after having labored thus hard during the fore part of the day, should, in the afternoon, take a notion to see if it could not make a living in some easier way? Would it be very much worse than many types of humanity? Well, as it passes around to other hives it catches the perfume of the clover honey they have gathered in a like manner, and, by some sort of an operation in its little head, it figures out that, if it could abstract some of this, unperceived, and get it safely into its own hive, it would be so much the richer. I presume it has no sort of care whether these other folks die of starvation or not. That is none of its concern.

With all of their wonderful instincts, I have never been able to gather that the bees of one hive ever have any spark of solicitude as to the welfare of their neighbors. If, by loss of a queen, the population of any hive becomes weak, and the bees too old to defend their stores, the very moment the fact is discovered by other colonies they rush in and knock down the sentinels, with the most perfect indifference, plunder the ruined home of its last bit of provision, and then rejoice in their own home, it may be but a yard away, while their defrauded neighbors are so weak from starvation as to have fallen to the bottom of the hives, being only just able to feebly attempt to crawl out at the entrance. Had it been some of their own flock, the case would have been very different indeed; for the first bee of a starving colony will carry food around to its comrades, as soon as it has imbibed enough of the food furnished to have the strength to stagger to them.

Well, suppose the bee mentioned above, in prowling around in the afternoon or some other time, should find a colony so weak or so careless that it could slip in unobserved, and get a load from some of the unsealed cells, and get out again. After it has passed the sentinels outside it will usually run but little danger from those inside, for they seem to take it for granted that every bee inside is one of their number. There is danger, though; for should it betray too great haste in repairing to the combs of honey they will often suspect something; so it assumes an indifference it is far from feeling, and loiters about very much as if it were at home, and finally, with a very well-assumed air of one who thinks he will take a lunch, it goes to the cells and commences to fill up. Very often, when it gets pretty well "podded out" with its load, some bee approaches, apparently to see if all is right. When the robber once gets its head into a cell, however, it seems to have lost all sense or reason; and if it is discovered at this stage to be a stranger and a thief, it is often pounced upon and stung with very little ceremony. How do they know a stranger from one of their own number, where there are so many? It is said they know by the sense of smell; this may be the principal means, perhaps, but I think they depend greatly on the actions and behavior of a bee, much as we do when judging of the responsibility of a man who asks to be trusted. We can give a very good guess, simply by his air or manner, or even by the sort of letter he writes. If a robber is suspected, and a bee approaches for the purpose of satisfying itself, it is a very critical moment, and one becomes intensely interested in watching the performance. The robber will stand its ground, if it is an old hand, and permit himself to be looked over with a wonderful indifference; but one who has watched such scenes closely will detect a certain uneasiness, and a disposition to move slowly toward the entrance, that it may be the better able to get out quickly, when it discovers things to be too hot for it inside. If the bee that first suspects it concludes it is an interloper, it begins to bite it, and grab hold of its wings to hold on until others can come to help. The thief has now two chances to escape, and sometimes it seems meditating which to adopt; one is, to brave it out until they shall perhaps let it alone, and then slip out unobserved. The

other is, to break away and trust to its heels and wings. The latter plan is the one generally adopted, unless it is a very old and "hardened sinner" in the business. One that has been many times in such scrapes will usually get away, by the latter plan, by an adroit series of twists, turns, and tumbles, even though three or four bees have hold of it at once. Some of these fellows, by a sudden and unexpected dash, will liberate themselves in a manner that is also wonderful, and then, as if to show their audacity, will wheel about and come back close to the noses of their retainers of a minute before.

But in case the bee gets its load, and makes its way out unobserved, it gets home very quickly, you may be sure, and, under the influence of this new passion for easily replenishing its hive with the coveted sweets, it rushes out with a vehemence never known under any other circumstances. Back it goes and repeats the operation, with several of its comrades at its heels. Does it tell them where to go? I wish to digress enough here to say that I do not believe in a so-called language among bees, or animals in general, further than certain simple sounds which they utter, and which we may learn to interpret almost if not quite as well as they do. When a bee comes into the hive in such unusual haste, podded out with its load in a way also rather unusual where it is obtained from ordinary stores, its comrades at once notice it, and, either from memory or instinct, they are suddenly seized with the same kind of passion and excitement. Those who have had experience at the gambling-table, or in wild speculations of other kinds, can understand the fierce and reckless spirit that stirs these little fellows. Patent hives illustrate the matter very well. A man who afterward became editor of a bee-journal once held up before my untutored eyes a right to make a patent hive, saying:

"Mr. Root, I get $5.00 for these rights, and they do not cost me more than the paper they are printed on—less than half a cent apiece."

The idea that $5.00 bills could be picked up in that way, compared with the slow way I was in the habit of earning them, so impressed itself on my mind that I could hardly sleep nights; but after I had taken that amount from several of my friends and neighbors for the "right," I concluded that money without a clear conscience is not just the thing after all. Can we blame the poor bees for being so nearly human? Well, the bees, when they see a comrade return in the way mentioned, seem to know, without any verbal explanation, that the plunder is stolen. Anxious to have "a finger in the pie," they tumble out of the hive, and look about, and perhaps listen, too, to find where the spoil is to be had. If they have, at any former time, been robbing any particular hive, they will repair at once to that; but if it is found well guarded, those used to the business will proceed to examine every hive in the apiary.

INTELLIGENCE OF THE HONEY-BEE.

One afternoon the door of the honey-house was left open, and the bees were doing a "land-office" business, before the mischief was stopped. After closing the door until they had clustered on the windows in the room, it was opened, and the process repeated until all were out; but all the rest of the afternoon they were hovering about the door. Toward night they gradually disappeared; and when I went down, about sundown, to try a new feeder, not a bee was near the door. I put the feeder in front of a hive where the bees were clustered out; and as soon as a few bees had got a taste, and filled themselves, they of course went into the hive to unload. I expected a lot to come out, as soon as these entered with their precious loads, but was much astonished to see an eager crowd come tumbling out, as if they were going to swarm, and still more when they rushed right past the feeder and took wing for— where do you suppose? the honey-house door, of course. How should they reason otherwise, than that it had again been left open, and that was where these incomers had found their rich loads? On finding it closed, back to the hive they came, to repeat the manœuvre over and over.

As another evidence of the wonderful intelligence and almost reasoning power of the honey-bee, I will make an extract from *Gleanings in Bee Culture*. This item was written by A. I. Root.

On the 12th of September a shipment of honey came in, and two 60-pound cans had been damaged so that the contents had leaked out and run through the floor of the box car. The railroad company had agreed to take the car away at half-past ten; and as the weather was cool the bees had not discovered it at that time. Unfortunately the company failed to move the car as agreed, and I knew nothing of it till I was apprised something was wrong by the unusual number of bees swarming around the windows and doors of the factory. Then I made a little row in the camp. We carried a hose over to the leaky car and washed away the honey, cleaning it from the gearing, ironwork, and under side of the car unti

the bees were pretty well satisfied there was nothing more to get, although they were hanging around in great numbers. To prevent the bees from getting the honey inside the car, our boys covered the floor pretty well with sawdust. About three o'clock the engine came around and pulled the car away. A little after four, some men who were loading wheat informed us our bees were making them a great deal of trouble. I at once jumped to the conclusion that the company, instead of taking the car entirely away, as agreed, had only removed it to another location in the yard, and that the sticky car was still enticing our bees. I went over, saw the sawdust on the floor on which they were dumping bags of wheat, and concluded it was the honey-car; but while I was puzzling my head to account for the fact that the ironwork under this car showed no trace of honey or water either, a man called to me and pointed to *another* car in still another location, just swarming with bees around its door, inside and out. Then I "caught on." Do you see the point, friends? There was not a particle of honey in or around either of the two cars I was looking at. After the honey-car had been pulled clear out of town, the bees, not willing to give up, proceeded to "leave no stone unturned," and were investigating every car having an open door that, in their judgment, *might* be the one that had been pulled away. When they found one with sawdust spread over the floor they naturally concluded *that* was the car, and got down on their hands and knees (figuratively) searching in the sawdust for the honey. The other bees, seeing them thus employed, naturally concluded this was the place. Others, having learned that one box car contained so rich a find, concluded that a search through all the cars in the yard might possibly reward them for their investigation; and it was only in the cool of the evening that they were willing to stop digging in that sawdust, and be convinced there were no more honey-cars in the neighborhood.

Now, friends, it may not be true that bees recognize colors, but they certainly do take in the general makeup of objects. They are not only able to recognize a hive, but they know a box car at sight; and even if you move it to a different location they take in its general appearance so that they know pretty well how to find it in case of removal. I am not prepared to prove that they read the letters "Big Four" on the side of that car, nor that they remembered there was an enormous figure 4 printed in white on the red door of the car they wanted; but I tell you they came pretty close to it.

Of course, bees have particular notes,[567] as of joy, sorrow, anger, despair, etc., which are produced by the wings, usually when on the wing, but I am quite sure they are unable to communicate to each other more than a single idea. In other words, they have no faculty of telling their fellows that a lot of honey is to be had in a feeder at the entrance, and that it would better be brought in quickly, or other bees may find it. A bee goes out in the spring, and, by smelling around the buds, discovers honey and pollen; when it comes into the hive, the others see it and start out, and hunt it up in a similar way. For further information on this subject, see SWARMING.

If you will turn back and read ANGER OF BEES, you will get a very good idea of the causes that start bees to robbing. Read, also, BEE-HUNTING, FEEDING, etc. As a general thing, bees will never rob so long as plenty of honey is to be had in the fields. During a bountiful flow I have tried in vain to get bees to take any notice of honey left around the apiary. At such times we can use the extractor right in the open air, close to the sides of the hives, if need be. On one occasion I remember leaving a comb of unsealed honey on the top of a hive, from morning until noon, and not a bee had touched it. It seems they preferred to go to the clover-fields, in the regular way, rather than to take several pounds from the top of a neighboring hive. I can readily suppose that they did not have to visit anything like a hundred blossoms at this time, and perhaps they secured a load in going to not more than a half-dozen. Such a state of affairs is not very usual in our locality. We have very few days during the season when it would be safe to use the extractor for a whole day in the open air; the bees will generally learn to follow the freshly uncapped combs about, and that it is easier than going to the fields. The first indication of robbing which you will have, will probably be the cool and wicked way of stinging that I have described in ANGER OF BEES.

After the season begins to fail, you may expect that every colony in your apiary will be tried. As a rule, any fair colony will have sentinels posted to guard the entrance, as soon as there is a need of any such precautions. The bee that presumes to think it may enter for plunder will be led off by "the ear," if I may so express it, and this will be repeated until it learns that there is no chance for speculation at that house. At the close of the honey harvest we should be sure that there are no feeble hives that may be overpowered, for one such may start the fashion of robbing, and make it a much harder matter to control this propensity. An apiary, like a community, may get so demoralized that thieving becomes a universal mania. "A stitch in time will save" a great many more than nine, in this case. Be sure that each colony has the entrance contracted, and, in fact, the space occupied by the bees also, in proportion to their numbers. Give them only so many combs as they can cover, if you wish them to defend them properly from either moths or robbers.

Colonies without either queen or brood are not apt to fight for their stores very vigorously, so it will be well to see that they have either one or both, should there be an attack made on them. It is hardly necessary to repeat what has been said about Italians being better to defend their stores than the common bees. A few Italians will often defend a hive better than a whole swarm of black bees.

HOW TO KNOW ROBBER-BEES.

It sometimes puzzles beginners exceedingly to know whether the bees that come out are robbers, or the ordinary inmates of the hive.

A robber-bee, when it approaches a hive, has a sly, guilty look, and flies with its legs spread in a rather unusual way, as if it wanted to be ready to use its heels as well as wings, if required. It will move cautiously up to the entrance, and quickly dodge back, as soon as it sees a bee coming toward i . If it is promptly grabbed for as soon as it attempts to go in, you need have but little fear. If a bee goes in and you can not well tell whether it was a robber or not, you must keep a close watch on the bees that come out. This is a very sure way of telling when robbers have got a start, even at its very commencement. A bee, in going to the fields, comes out leisurely, and takes wing with but little trouble, because it has no load. Its body is also slim, for it has no honey with it. A bee that has stolen a load is generally very plump and full, and, as it comes out, it has a hurried and "guilty look;" besides, it is almost always wiping its mouth, like a man who has just come out of a beer-shop. Most of all, it finds it a little difficult to take wing, as bees ordinarily do, because of the weight. In BEE-HUNTING I related how a bee, laden with thick undiluted honey, would stagger several times under its load before it could take wing for its final trip home. Well, the bee, when it comes out of the hive with the honey it has very likely just uncapped, feels instinctively that it will be quite apt to tumble unless it can take wing from some elevated position, and therefore it crawls up the side of the hive before it launches out. When it first takes wing it falls a little by the weight of its load, before it has its wings fully under control, and therefore, instead of starting out as a bee ordinarily does, it takes a downward curve, coming quite near the ground before it rises safely and surely. With a little practice you can tell a robber at a glance by its way of coming out of the hive, particularly by that fashion of running up the side of the hive before taking wing, in the way I have mentioned.

HOW TO TELL WHERE THE ROBBERS BELONG.

If you are a bee-hunter you will probably line them to their hive without any trouble; but if you are not, you can easily find from which hive they come by sprinkling them with flour as they come out of the hive being robbed. Now watch the other hives, and see where you find the floured bees going in. I can generally tell in a very few minutes, by the excited actions of the robbers, already mentioned.

HOW TO STOP ROBBING.

As to the best mode of procedure, a good deal will depend on circumstances. If the bees in the whole apiary are robbing in a wholesale way from the honey-house, or from any place where a supply of honey or syrup is kept, the obvious remedy is to shut the door of the dwelling or cut off the supply. If the bees have got into a barrel through a bunghole, the chances are we shall find, after the head of the barrel is taken out, that there is a peck or more of bees swimming around in the honey. If robbing were very bad I would drive the bung into the barrel, and then, after the uproar has quieted down, remove the bung and run the honey through a strainer from the bunghole.

The bees shortly will stop robbing if all sweets within their reach are removed, or so protected that they can not get at them; but even then the apiary will be out of balance for the rest of the day, and more or less for two or three days following, because the bees will be trying to find where they can find more sweets.

Sometimes robbing is started by some one in the neighborhood making sweet pickles, canning fruit, or doing any thing that causes a strong odor of sweet or sour during its preparation: and the only thing the bee-keeper can do is to have the house screened; or if the case is very bad, and the bees keep on "sticking their noses into other people's business," I would recommend smoking the entrances of all the hives with tobacco smoke. Half a dozen whiffs of smoke should be blown into each entrance, one after the other. In half an hour the dose should be repeated. This will cause the bees to quiet down until such time as the canning-work or the pickle-making is over at the house where the bees are "making themselves too familiar."

The best treatment for a general robbing throughout the apiary is prevention. The screen doors and other doors of the honey-house should be self-closing. Unless they are, some one will be almost sure to forget and leave one of them open. If the doors are not self-closing, then all the honey that is stored in the building should be put into hives, shipping-cases, cans, or barrels, or any receptacle where the bees can be kept from helping themselves; then if perchance the door is left open no harm will be done.

ROBBING OF NUCLEI OR WEAK COLONIES.

But there is another kind of robbing that is much more common, and which is apt to perplex the beginner more than any thing else, and that is the onslaughts that are often made on weak colonies or those that are disinclined to make a defense. Nuclei with large entrances are especially subject to the attacks of bees from strong stocks, and will very often be cleaned out entirely before the apiarist discovers the mischief. By that time the whole apiary will be in a perfect uproar; and as soon as the supply of honey has been exhausted in the one nucleus the robbers will hover around all other entrances, and if they find one poorly defended they will get in more bad work later. During a dearth of honey there are always some bees that make a business of smelling around, and it is a wise precaution always to have the entrances of nuclei contracted down to a width where one or two bees can pass at a time. But we will suppose that a hive has been overpowered, and that its own bees are making no defense, realizing, probably, that resistance is useless. If any thing is done to save the colony it must be done quickly. Grab up a handful of long grass, strew it closely around the entrance, and then spray or sprinkle a dipperful of water on the grass. Scatter more grass over the entrance, and spray again. The invaders will not, as a rule, crawl through wet grass to get into the hive, while on the other hand those that have already gotten into the hive will get out, and will return to their homes. In the mean time the regular inmates of the hive, as soon as they are given a little assistance, will begin to set up a defense. The grass should be kept wet for at least an hour or two, and possibly till sundown; but before strewing the grass on the entrance I would advise contracting it down so that only one or two bees can pass at a time. *Never close the entrance up entirely*, no matter how bad the bees are robbing. If it is a hot day the large number of robbers in the hive, together with the regular inmates, would be almost sure to smother to death; but if the entrance is contracted down so that one or two bees can pass at a time when the hive becomes exceedingly warm, the bees can escape, and thus relieve the situation. If it is a very bad case of robbing, in place of clear water for strewing on the grass use a mixture of carbolic acid and water — 500 parts of water to one of acid; but as a general rule there will not be time to get the acid, and so clear water will have to be used at once, and afterward use the mixture if it can be obtained.

Another good way to stop robbing is to put a bee-tent or screen over the hive, as described further on. This should be anchored to the ground, and then the robbers, as fast as they come out of the hive, will escape into the tent. In the mean time no more can get in, because the hive is closed to all outside bees. In half an hour or so the tent should be lifted for a moment, turned upside down, when the robbers will immediately fly for home.

But, better still, I would recommend making a hole in the peak of the tent. If there are one or two holes it will do no harm. The robbers will gradually work up toward the peak, and, traveling along, will discover the opening and return home; but, on the principle of the bee-escape, not one of them will think of going back to the hole whence it came, but will make a dive for the front of the entrance, which is barred by the mosquito-netting. In lieu of the tent a large piece of mosquito-netting could be thrown over the hive, and then held down by means of a few bricks and stones around its edges. As a rule we prefer the use of the bee-tent, because one may rest assured it will not be necessary to watch the colony closely after that. It should be left on the hive until nightfall; then the colony may be examined; and if the brood has not been destroyed, and there is a sufficient number of bees left to make a defense, the entrance may be contracted down to a space so that but one bee can pass. In the morning be on hand early, and see what kind of defense the bees are making. If they are not equal to the occasion, then put the tent over and leave it on all day or until such time as they shall have gotten over their demoralization.

Sometimes when a colony has been almost completely robbed out it is better to let the robbers finish up the job; for it is a fact that when the entrance is closed or when

further ingress to the hive has been shut off by means of a tent or otherwise, those same robbers will then pounce on other nuclei in the immediate vicinity, because the use of the tent or the wet grass does to a certain extent change the appearance of the hive, causing the robbers to conclude they have made a mistake, and that, therefore, the hive they have been robbing is one next to or near it. It is Dr. Miller and a number of other prominent bee-keepers who believe that, when a colony has been almost completely robbed, it should be left alone. As soon as all the honey is gone, and there is nothing more for the robbers to get, they will quietly withdraw, go back home satisfied, concluding that they have taken all the honey; but if the supply is shut off *suddenly* those same bees *know* there must be more, and conclude there must be a way to get it, and so they keep up the search for some other colony that may have a supply just as available.

Well, we will say the colony has been almost cleaned out, night has come on, and things in the apiary have assumed their natural order. If there are not enough bees left to make up a colony or even a fair nucleus, take away all the old combs, sweep out all the dead bees, and give them a frame with a very little honey in it; contract the entrance down to one bee-passage, and then watch them the next morning to see whether they will put up a defense. As a further precaution it might be well to throw a little wet grass in front of the entrance. As a general rule, bees that are given a little rest, and a chance to recover from their demoralization, will fight just as hard; and probably the second time after they have been helped a little they will be able to maintain their rights.

In trying to people our house-apiary in the fall, when it was first built, I had trouble with one certain colony. In fact, if any robbing was going on anywhere it was sure to be these hybrids who were at the bottom of the mischief. After I had tried every plan I had heard recommended, and still these fellows would persist in pushing into every new colony I started, the idea occurred to me that, on the principle that it takes a rogue to catch a rogue, it would be well to try to see how they would repel robbers. I simply took the greater part of the combs from the robbers, bees and all, and carried them into the house-apiary, and put them in place of the colony which they had been robbing. The effect was instantaneous. Every laden robber-bee that came home with its load, on finding the queen and brood gone, at once showed the utmost consternation, and the passion for robbing was instantly changed to grief and moaning for the lost home. The weak colony which they had been robbing, and which had only a queen-cell, was placed with them, and they soon took up with it, and went to work. The robbers newly domiciled in the house-apiary repelled all invaders with such energy and determination that the rest seemed to abandon the idea which they, doubtless, had previously formed; viz., that the house-apiary was a monster hive but ill garrisoned, and I had but little trouble afterward. Before I swapped them, as I have mentioned, I had serious thoughts of destroying the queen, simply because they were such pests; but the year afterward, this colony gave me in the house-apiary over 100 lbs. of comb honey.

FOLDING BEE-TENT.

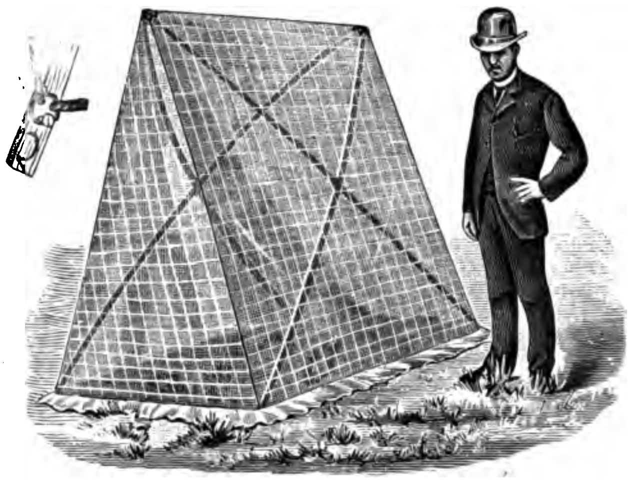
One of the almost indispensable articles in a well-regulated apiary is some sort of bee-tent or large cage covered with mosquito-netting which one can put over himself and hive while he is making the necessary examination. It should be light so it may be easily handled; should be at least six feet high inside, and long enough and wide enough to take in the hive and the bee-keeper comfortably while he is working. In our apiary we use two forms of tent—one a regular square house made of wire cloth, and another one which can be folded as shown in the illustration, when not in use. With either one of these, preferably the latter, one can, during the robbing season, even when bees are acting their very meanest, perform all the necessary work with the hive, such as cutting out queen-cells, introducing, etc., without a robber being able to get at the combs. Of course, the bees in the hive will fly out, bump their heads against the mosquito-netting, and finally reach the roof of the tent; but as soon as the bees find they are caged they will immediately try to get out through the hole in the top, where they will very soon make their escape.

HOW TO MAKE.

Take four basswood sticks, about 8½ feet long, and fasten them together like letter X's, with a good strong screw where they cross A piece of good strong tarred twine, or small rope, makes the ridge-pole, as seen in the engraving, and this same twine unites the sticks at their tops. The mosquito-bar is sewed into a sort of bag, having the same strong twine all round

its lower edges, and down each of the four corners. At these corners are also sewed metal rings, and these rings, when pulled down strongly, will loop over screw-heads, near the lower ends of the four sticks. When thus looped over, the sticks are bent, or bowed, so as to give room in the top of the tent. The whole structure weighs less than five pounds, and yet it gives room inside for a hive, and to do all necessary work. The basswood sticks are 1 x ¾ at the lower end, and tapered to 1 x ⅜ at their upper end, with the corners taken off, to make them as

TENT FOLDED.



FOLDING BEE-TENT, READY FOR USE.*

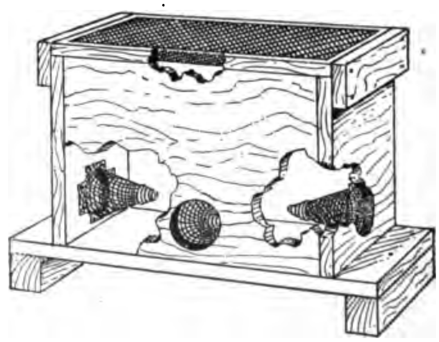
light as possible. Where the bend comes, they are scraped a little thinner.

In the small cut below at A is shown the way the ring is looped over the screw-heads, and just below is seen the end of a 2¼-inch wire nail, bent so it can be (when turned with the point downward) used as an anchor to keep the tent from blowing over. If the sticks are spread a little when the anchors are pushed into the ground, the tent stands very securely.

HOW TO TRAP ROBBERS.

Mr. McIntyre, of California, and some others who have reported in *Gleanings in Bee Culture*, use a robber-trap. Mr. McIntyre describes his and its manner of use as follows:

Last season, after the honey-flow I reared and introduced over 300 queens; and, being much annoyed by a band of educated robbers that had learned enough to go wherever the smoker was, I determined to try to trap them. The plan of keeping them busy by slow robbing had not come out yet. After trying several devices, and failing, I finally hit on one that was successful. It is made of an ordinary 10-frame Langstroth extracting-super, without frames; a bottom-board is nailed on the bottom, and a three-inch hole bored in each side and end near the bottom. A short wire-cloth cone is pushed into each hole, and nailed; a ⅜ hole is made in the apex of each cone, and a West cell-protector screwed on to finish out the cone. The cover is made of two sheets of wire cloth, one nailed on each side of a frame the size of the top of the hive. This is to prevent the robbers inside from passing the honey used as a bait through the wire cloth, to the robbers outside. I hang a frame of honey inside for bait. It is necessary to have plenty of light above to draw the bees away from the cones below; but the hot sun should not be allowed to shine in on the bees, for it will kill them. By setting this trap out in the apiary with a lighted smoker on it I soon caught all the robbers that were in the habit of following the smoker, and killed them. I would not kill bees in the spring or any other time if they were of any value; but these old hairless robbers were of no value at that time. At other times I catch the robbers and keep them



ROBBER-TRAP.

imprisoned until dusk, when they are glad to get home and quit. After I had quit working with the bees in the fall I went out to the apiary one day and

*Our artist has shown the bottom fringe of the tent as common cloth; it is nothing but a continuation of mosquito bar.

found a weak colony overpowered. The robbers were just tumbling over each other, and the whole apiary was in an uproar. My honey-house has bee-escapes on the windows, so I just carried the hive inside that was being robbed, and placed the trap on the stand where the hive was. In a short time I had nearly all the robbers in the trap. I kept them there until about dusk in the evening, when they were glad to go home, and next day all was quiet. J. F. McINTYRE.

Fillmore, Cal.

WHAT HAPPENS IF ROBBING IS NOT STOPPED.

Well, when the work is under real headway, the honey of a strong colony will disappear in from 2 to 12 hours; the bees will then starve in the hive, or go home with the pillagers, or scatter about and die.[571] This is not all: when the passion is fully aroused they will not hesitate to attack the strongest stocks, and you will find your bees stung to death in heaps, before the entrances. This may, after a spell, put a stop to it, but I have seen them push ahead until every hive in the apiary was in an uproar, and it seemed as if every bee had gone crazy, sure. At such times the robbers will attack passers-by in the streets, and even venture an attack on cats, dogs, aye, and hens and turkeys too. Like the American Indians when infuriated at the sight of blood, every bee seems to have a demoniacal delight in selling its life by inflicting all the torments it possibly can, and feels sad because it can not do any more mischief.

The account below, taken from *Gleanings in Bee Culture*, illustrates very vividly what I have tried to describe.

I send you a paper, the *Valley Herald*, published at our county seat, which has a little article on "Bees on a Rampage." I should be glad to hear your views on the subject. What caused those bees to act so, etc.? JOHN W. HOODENPYLE.

Looney's Creek, Tenn.

BEES ON A RAMPAGE.

Mr. Elisha Tate, who lives some fifteen miles from this place on the head of Battle Creek, met with quite a singular misfortune on the 19th inst. He has, or did have at that time, about twenty hives of bees, and on that day, while all were away from the house except a daughter and the baby, the bees became mad from some cause or other, left the hives in large swarms, and commenced to sting every living thing on the place. They attacked the daughter, who fled from the house, leaving the babe on the bed. A fine jack was stung to death in the stable; all the chickens were killed, and a sheep, that was around the house, was stung so badly on the nose that that organ swelled to huge dimensions, causing death by suffocation. The cries of the daughter brought Mr. Tate to the house, and he proceeded to rescue his babe, which he found literally covered with bees; and we understand that it was with great difficulty that its life was saved. Mr. T. attempted to destroy the bees at night by piling fodder on the hives and setting fire to it, but it only served to again arouse them, and they attacked the family and compelled them to abandon their house and go to a neighbor's.

No one can account for the strange occurrence. Some think that a snake must have visited the hives, as it is known that bees have the greatest antipathy toward snakes.

In all probability the account is considerably exaggerated, as such things usually are before they get into the papers, but it affords an excellent lesson, nevertheless, on the results of letting bees get into a habit of robbing each other, or of finding honey scattered about the premises. I tried, in ANGER OF BEES, to illustrate it, but the above does it still better. The worst season seems to be after basswood is over, and the bees seem to get especially crazy, if they even get a smell of this aromatic honey left carelessly about the hives. One who has never seen such a state of affairs can have but little idea of the furious way in which they sting every thing and everybody. The remedy is to get a good smoker and put in enough chips or planer shavings to make a big smoke; with one hand work the smoker bellows, and with the other proceed to close every hive that shows any symptoms of being robbed. Shut up every bit of honey where not a bee can get at it, and do your work well; for at such times they will wedge into and get through cracks that would make one think *inch boards* were hardly protection enough. Just before dark let all the robbers go home, and be up betimes next morning to see that all entrances are close and small, and that all the hives are bee-tight. An experienced hand will restore peace and quietness in a very short time, in such a demoralized apiary. Black bees are much worse than Italians, for the latter will usually hold their stores against any number of assailants; good, strong, well-made hives, filled with Italians, with plenty of brood in each, will be in little danger of any such "raids," although we have seen the wounded and slain piled up in heaps, before robbers would desist and give up trying to force an entrance.

The love of honey, my friends, is by far more potent than "snakes" in demoralizing an apiary. I do not think bees have any particular enmity to them.[186]

There is one more point: If in uncapping drone brood, or in cutting out brood to rear queens, you leave the cappings or bits of comb scattered about, the bees will get a

taste of the milky fluid and juices of the brood, and it seems to craze them worse than honey even, if that is possible. Below is a letter illustrating it.

CROSS BEES.

I had some of the crossest bees this summer that were ever heard of. They would fight the top of a stovepipe that runs up through a shed roof; there would be 50 or 100 bees at once, just whacking against that pipe, and very many fell into it, and burned to death. They would dive into my smoke-pan, and burn up in that, and sting folks along the road. What the cause was I could not imagine, but at last I happened to think. I had been destroying drone brood, and when it was in a milky state I could not shake it out of the combs; the bees would eat it and it just made them crazy and ugly. Well, I always want to be sure about any thing, so I left it off for awhile and they became peaceable again. On again giving them access to the milky brood, the same result followed.

Carson City, Mich. D. GARDNER.

WORKING WITH BEES BY LAMPLIGHT WHEN ROBBERS ARE TROUBLESOME DURING THE DAY.

I believe I have before mentioned my troubles in trying to people the house-apiary in the fall. Queens were already hatched in the lamp-nursery, and, unless the colonies were divided at once, so as to make use of them, all would be lost. The surplus combs for making these late swarms were in the upper stories, and the robbers knew it; for no sooner was a cap raised than they were on hand; and before I could get the brood-combs to go with them (I found that the bees would not adhere even to their own combs, unless some of them contained unsealed brood), a smart traffic would be under way. It came night, and my hives and queens were in all sorts of bad shapes. I was glad to have it come night, I assure you, for I longed for the time when the robbers would be compelled, by the gathering darkness, to go home. I presume many of you have had cause to repent trying to work with bees when it began to grow dark, but I got the idea into my head that, with some good lamps with nice shades on them, I could do my work in the evening. I went at once and got a lamp, and walked around the apiary viewing the inmates of the different hives that were clustered out at the entrances, humming merrily, I presume in remembrance of the rich loads they had but an hour before snatched from me. Scarcely a bee took wing, and I then ventured to open a hive. With the lamp on one of the posts of the trellis, I found I could handle the bees almost as well as in daylight, and, to my intense relief, not a bee would leave its hive, no matter how many combs were held temptingly under their very noses. I went to work, divided my hives, caught the queens, and even handled vicious hybrids, with less stings than I could possibly have got along with in the daytime.* 187

"LIKE CURES LIKE;" OR, HOW TO PREVENT EXCESSIVE ROBBING BY SLOW ROBBING.

Before or after the honey season, the bees are quite apt to be poking their noses into the combs of honey when the hives are open. These bees are usually some of the old inveterate robbers that have become skilled in the art of stealing. What shall we do with them?

Satan finds some mischief still
For idle hands to do.

This suggests the remedy; namely, give these bees something to do. In a word, we allow them to rob slowly. This is done by tiering up several hives containing combs with more or less honey. The hives are stacked up four or five high, upon an ordinary bottom-board, and covered with an ordinary cover. But it is desirable to afford a little extra ventilation at the top; hence we put on a wire-cloth screen, as shown under MOVING BEES, and over this the cover raised up about an inch high on four blocks. Now, then, if we have not previously done so, we contract the entrance at the bottom of the whole tier, to a space that will just allow *one bee to pass at a time.*

BORROWING.

Before closing this subject of robbing there are a few more points to be mentioned. There is a kind of pillaging called borrowing, where the bees from one hive will go quietly into another, and carry away its stores as fast as gathered; but this usually happens where the robbed stock is queenless, or has an unfertile queen. As soon as they have eggs and brood, they begin to realize what the end of such work will be. This state of affairs seldom goes on a great while. It either results in downright robbing, or the bees themselves put a stop to it.

Caution to Beginners: — The first year I kept bees I was in constant fear that they would get to robbing, as I had read so much about it in the books. One afternoon in May I saw a large number of bees passing rapidly out and in, at a particular hive, and

* Since the above was written we have found that a good lantern is preferable to a lamp. The latter is apt to be affected by light breezes, and is often blown out. The former, while not open to this objection, will receive rougher handling. During the season of 1886 we used the lantern in the apiary with entire success.

the more I examined them the more I was persuaded that they were being robbed. I contracted the entrance, but it seemed to make little difference. I finally closed it almost entirely, compelling the bees to squeeze out and in, in a way that must have been quite uncomfortable, at least. After awhile they calmed down, and we had only the ordinary number of bees going out and in. " There," thought I, " if I had not read the books and known how, I might have lost my bees," and I presume I felt very wise if I did not look so. On turning my head, behold, the robbers were at another colony, and they had to be put through the same programme; then another, and another; and I concluded a host of robbers had come from somewhere, and made a raid on my apiary, and that, had I not been on hand, the whole of them would have been ruined. I had got very nervous and fidgety, and, when I found the whole performance repeated the next day, I began to think bee culture a very trying pursuit. Well, in due course of time I figured out that there was no robbing at all, but that it was just the young bees taking their afternoon playspell.

ROCKY - MOUNTAIN BEE - PLANT (*Cleome Integrifolia*). This is a beautiful plant for the flower - garden, to say nothing of the honey it produces. It grows from two to three feet in height, and bears large clusters of bright pink flowers, as shown in the cut.

It is a near relative of the SPIDER-PLANT, which see. It grows naturally on the Rocky Mountains, and in Colorado, where it is said to furnish large quantities of honey. Although it succeeds easily under cultivation, in our locality I can not learn that it has ever been a success pecuniarily. With this, as well as with all other plants, it must be borne in mind that, to yield honey enough to give it a fair test, acres are needed, instead of little patches in the garden. The seed has been offered for sale for several years past, as a plant to be cultivated for honey; even if it does not pay for honey, it will pay to have a bed of it on account of its beauty.

The engraving was copied from a larger-sized picture, in Prof. Cook's " Manual of the Apiary." During the season of 1879 we had a number of the plants growing in our honey-garden. It was, however, so much inferior in looks, as well as in the amount of honey produced, to the spider-plant, that we did not take the pains to save any of the seed. The two plants very much resemble each other, but the latter is a much stronger and finer-looking plant, and has a rank luxuriance of growth that the Rocky-Mountain bee-plant has not.

To have them do well in our gardens, that is, give us a good yield of honey, the seeds would better be planted in a box indoors, say in February or March. Set them out when all danger of frost is past, and give them good rich soil, with about the same cultivation you would give your cabbages.

The Michigan Agricultural College experimented, in 1891, with several acres of the plants, for the sole purpose of testing their

ROCKY-MOUNTAIN BEE-PLANT.

honey-producing qualities. They found it exceedingly difficult, however, to get a good stand of plants. In fact, I do not know how a perfect stand can be obtained without transplanting; and as this makes the expense equivalent to a field of cabbages or strawberries, of course the honey produced did not come anywhere near paying expenses. Some of our seed catalogues have described it in glowing terms, and greatly exaggerated its honey-producing qualities. Flaming colored prints of the flower covered with honey have also been given, and I suppose many people have been deluded into the belief that these plants could thus be grown in small patches so as to produce honey profitably. It has been advertised under various fanciful names, such as "The Great Mexican honey-plant," etc.

ROYAL JELLY. See ANATOMY OF THE BEE; also QUEENS.

A BUSH OF CALIFORNIA BUTTON SAGE.

S.

SAGE — a general name for white sage, black sage, and button sage, in California. These honey-bearing plants also belong to the great family of *Labiatæ*, or the mint family. Labiate means lip-shaped; and if you look closely you will see that plants belonging to this family have blossoms with a sort of lip on one side, something like the nose to a pitcher. Many of this family, such as CATNIP, MOTHERWORT, FIGWORT, GILL-OVER-THE-GROUND, have already been mentioned as honey-plants, and the number might be extended almost indefinitely. The sage we have particularly to do with is the white mountain sage of California; and I do not know that I should be far out of the way in calling this one of the most important honey-plants in the world. The crops of honey secured from it within the past ten years have been so immense that the sage honey is now offered for sale in almost all the principal cities in the world, and a nice sample of well-ripened California honey, whether comb or extracted, is enough to call forth exclamations of surprise and delight from any one who thinks enough of something good to eat, and pleasant to the taste, to commit himself so far. I well remember the first taste I had of the mountain-sage honey. Mr. Langstroth was visiting me at the time, and his exclamations were much like my own, only that he declared it was almost identical in flavor with the famed honey of Hymettus, of which he had received a sample some years ago. Well, this honey of Hymettus, which has been celebrated both in poetry and prose for ages past, was gathered from the mountain thyme, and the botany tells us that thyme and sage not only belong to the same family, but are closely related. Therefore it is nothing strange if Mr. Langstroth was right, in declaring our California honey to be almost if not quite identical in flavor with the honey of Hymettus. This species of sage grows along the sides of the mountain, and blossoms successively as the season advances; that is, the bees first commence work on it in the valleys, and then gradually fly higher up, as the blossoms climb the mountain-side, giving them a much longer season than we have in regions not mountainous.

John H. Martin, of California, under the *nom de plume* of "Rambler," who has trav-

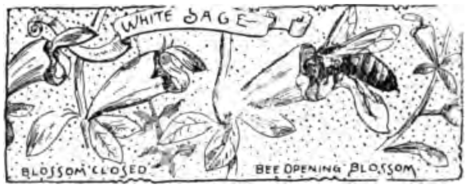
A STEM OF CALIFORNIA BUTTON SAGE WITH BLOSSOMS.

eled extensively in California, has this to say of the mountain sages. The manner in which the bee has learned how to open the trapdoor is particularly interesting.

The first sage to come into blossom is that variously called black sage, button sage, and bolled sage. Upon these buttons, or bolls, the little flower-tube appears, and is much like the flower-tube in the red-clover blossom. The button develops flowers from the outer edge of the button for several weeks. The bush is about five feet in height, bearing a large number of button-stalks, with several buttons to the stalk, the largest button being a little over an inch in diameter, and diminishing in size toward the tip of the stalk. A little drop of nectar can be squeezed from the little tube, just as we can squeeze it from the tube of red clover. When the flowering season is past, the buttons turn to nearly a black hue, and cling to the bush until the next season.

The habit and appearance of the white sage are entirely different. The woody portion and the leaves are nearly white, which gives it its name. The flowering stalk makes a rapid growth of several feet in one season, and the plant throws up a dozen or more of these stalks, all the way from three to eight feet in height. Each stalk is loaded with racemes of buds, which continue to produce flowers for several weeks.

The description of the white sage is not complete without giving the way in which the bee sips the nectar from the white-sage blossom. The opening



in the corolla is nearly large enough for the bee to thrust its head into; but, as if jealous of its treasured sweets, the flower is provided with a long projecting lip that curls up not unlike a letter S, and in such a manner as to close effectually the entrance. When I first saw a white-sage blossom, it was with much interest I speculated upon how the bee gained access to the nectar. Soon a busy worker darted in among the flowers, and, alighting upon the projecting portion of the S-shaped lip, it bent down under the weight of the bee, opening the door to its treasure-house, which the bee soon relieved of its contents. Upon the departure of the bee, the

STEMS AND BLOSSOMS OF CALIFORIA WHITE SAGE.

door immediately closed again, to be opened and reopened by the successive foragers. If the rainfall has been light, the white sage will not bloom so profusely; and, furthermore, the lip of the flower is stunted and so short that the bee can not find standing-room upon it; and, after vainly striving to gain an entrance, it reluctantly seeks another flower with well-developed flowers. The lip readily yields to the bee, and the load is secured as quickly from this flower as from the simple tube of the button sage. It is when the sages are in blossom, in May and June, that the bee-keeper has to hustle in order to keep his dish right side up.

A peculiarity of this honey is, that it is not inclined to candy, but remains limpid, during the severest winter weather. I have taken a sample so thick that the tumbler containing it might be turned bottom upward without its running at all, and placed it out in the snow, in the dead of winter, and failed to crystallize it. This is a very valuable quality of it, but it does not invariably remain clear. I presume the honey should be fully ripened in the hive, to have it possess this property, as it is well known that perfectly ripened clover honey will often possess this same property here, while unripened honey, of any kind, is much disposed to candy at the approach of cool weather. I believe some effort has been made to cultivate this plant; perhaps a soil that raises pennyroyal naturally would suit it, as they are nearly allied, and I have been told that pennyroyal yields considerable quantities of honey on the waste lands of Kelley's Island, in Lake Erie.

It has been said, that one soon tires of this beautiful aromatic flavor of the mountain sage, and that, for a steady diet, the white-clover honey of the Western Reserve far outrivals it. This may be so; for, as a general thing, I believe people usually tire of these strong and distinct flavors in honey, like those of basswood and mountain sage. For all that, dear reader, if you have never tasted mountain-sage honey, and are a lover of honey, there is a rich treat in store for you when you do come across some.

We have tried raising the plant on our honey-farm, but it seems to need a little coaxing in our climate, and I have not been able to discover that the blossoms furnish more honey here than many other plants. The secret of the immense yields from it in California is probably on account of the vast areas that it covers.

MAKING STRAW SKEPS IN ENGLAND.—*British Bee Journal.*

SIZE OF FRAMES. See HIVES.

SECTIONS See COMB HONEY and HIVE-MAKING.

SELF-SPACING FRAMES. See FIXED FRAMES and HIVES.

SEPARATORS. See COMB HONEY.

SKEP. The term "skep" is often used by old-fashioned bee-keepers to refer to colonies of bees in any kind of hive; but more properly it applies to box hives and straw skeps—the last named rarely seen in this country. In England and in many of the countries on the continent of Europe, the old straw skep is still used quite largely.

Lumber is expensive and straw cheap, and, as a consequence, one will see quite a few hives of the latter material in those countries; but movable frames are never used in these hives. The bees are allowed to build the combs just the same as mentioned under the head of BOX HIVES, which see. On the top of these skeps, in many cases, modern supers containing sections are used. The making of straw skeps for some cottagers is quite a little business of itself—requiring a certain degree of skill, as one will see by glancing at the picture at the left. I do not know what these skeps are sold for, but I am told that they are sold at a much less price than the modern movable-frame hives.

Straw skeps are never used in this country—at least at the present time; and if it were not for the familiar pictures of "ye olden times" we Americans would know but little about them.

SMARTWEED. See HEARTSEASE.

SMOKE AND SMOKERS. We can drive cattle and horses, and, to some extent, drive even pigs, with a whip; but one who undertakes to drive bees in any such way will find to his sorrow that all the rest of the animal kingdom are mild in comparison, especially as far as stubbornness and fearlessness of consequences are concerned. You may kill them by thousands; you may even burn them up with fire, but the death agonies of their comrades seem only to provoke them to new fury, and they push on to the combat with a relentlessness which I can compare to nothing better than to a nest of yellow-jackets that have made up their minds to die, and to make all the mischief they possibly can before dying.[189] It is here that the power of smoke comes in; and to one who is not conversant with its use, it seems simply astonishing to see them turn about and retreat in the most perfect dismay and fright, from the effects of a puff or two of smoke, from a mere fragment of rotten wood. What would we bee-keepers do with bees at times, were no such potent power as smoke known?

There have been various devices for getting smoke on to the bees, such as, for instance, a common tin tube with a mouthpiece at one end, and a removable cap with a vent at the other end, for the issue of smoke. By blowing on the mouth-piece, smoke can be forced out. Others, again, have used a tin pan in which was some burning rotten wood. This is put on the windward side of the hive, so as to blow smoke over the frames. All of these, however, were miserable makeshifts in comparison with the smokers of to-day.

BINGHAM SMOKER.

It is to the credit of Moses Quinby for first giving us a *bellows* bee-smoker. This was a great step in advance over the old methods of introducing smoke among the bees. In principle his original smoker did not differ essentially from the Bingham or the L. C. Root, that were introduced later. It had, however, one serious defect; and that was, it would go out, the fire-pot not being properly ventilated to insure a good draft. Some years after, Mr. T. F. Bingham, of Abronia, Mich., and Mr. L. C. Root, son-in-law of Quinby, then of Mohawk, N. Y., but now of Stamford, Ct., introduced bee-smokers to the world on the principle of the original Quinby bellows smoker, but with several decided improvements. The fire-cups, at the same time,

were made rather larger, and were ventilated in such a way that a continuous draft could be maintained, even when the smoker was not in use, thus preventing them from going out like the old original Quinby.

Of the two smokers the Bingham is the better—more reliable and more substantially made. While the L. C. Root smoker is not now made, the Bingham has a very large sale. It has recently been improved by the addition of a detachable curved snout to prevent fire dropping, and a safety device (a wire handle) by which the top can be removed for replenishing without burning the fingers.

Both smokers employ what is known as the hot-blast principle—that is, the blast of air from the bellows is blown *through* the fire. This makes a heavy volume of smoke—volume enough with the proper kind of fuel to subdue the worst kind of hybrids.

The Bingham is an excellent smoker, but has one defect—a comparatively weak blast. To overcome this objection the smoker below was brought out.

THE CRANE SMOKER.

In 1891 Mr. J. E. Crane, of Middlebury, Vt., introduced what is known as the Crane smoker, the principal feature of which is an ingeniously devised check-valve designed to prevent smoke from passing back into the bellows, and yet at the same time give a strong blast. When the smoker is not in use, the valve closes and makes a draft into the fire-cup; but the moment the bellows is pressed, the valve closes all outside connection, making a continuous and almost air-tight passageway from the bellows into the fire-cup. This enables the Crane to give a blast equal to that of the Clark, and yet the smoke, for pungency and subduing qualities, is equal to that coming from a Bingham. There is only one defect in the Crane; and that is, that the check-valve sometimes becomes a little clogged with creosote; but this is only after the smoker has been used continuously for a considerable length of time; and if one only has patience he can remove the valve, clean it, and put it back.

CORNEIL SMOKER.

Another smoker that was introduced two or three years afterward, and somewhat similar to the Crane in general appearance, is the Corneil. It receives the air from the bellows into the fire-cup in much the same manner as the Bingham, but takes advantage of a well-known principle by which induced air-currents are made to strengthen the blast of the smoker.

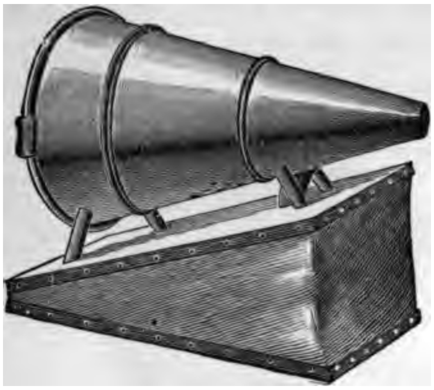
The Corneil is a very popular implement, and is used very largely by many of the most practical bee-keepers in the land. Both the Crane and the Corneil make use of a hinged curved snout by which it is possible to replenish the smoker very easily. A slight tap of the hand against the snout causes it to fly back, when the cup can be easily replenished with fuel. Another flip of the fingers will cause the top to fly into position, when the smoker is ready for use.

The object of the curved nozzle on all three of the leading hot-blast smokers is to prevent fire dropping. In the old-style smokers it was necessary in blowing smoke to tip the barrel almost upside down, or at such an angle that fire-embers would sometimes fall on the brood-frames and the bees. The new curved nozzle permits one to use the smoker almost right side up, and yet a stream of smoke can be poured on the combs.

COLD-BLAST SMOKERS.

All the foregoing are of the hot-blast type—that is, the blast is forced through the

fuel. Cold-blast smokers are constructed somewhat on the principle of an ejector; that is, air is conducted directly from the bellows by means of a tube, to a point inside of the fire-box, *ahead* of the fire, not through it; the result is a blast of cold air charged with smoke. In other words, the



CLARK COLD-BLAST SMOKER.

blast of air that is forced through the nozzle sucks with it the smoke just back of it, from the burning fuel. This principle was invented almost simultaneously in 1879 by J. G. Corey, of Santa Paula, Cal., and Norman Clark, of Sterling, Ill., each without the knowledge of the other. Of the two smokers, the Clark has the better construction.

RELATIVE MERITS OF THE HOT AND COLD BLAST SMOKERS.

For a large volume of dense smoke, the hot-blast smokers are away ahead. There was a time when the cold-blast bid fair to run out the hot-blast. The former was thought to have the advantage of being cheaper, using the fuel more slowly, and

COLD-BLAST PRINCIPLE ILLUSTRATED.

sending a *cold* blast of air upon the bees. But I doubt if this last feature is an improvement after all. Cold-blasts are used principally by bee-keepers having few colonies, the more extensive ones finding the hot-blast preferable.

FUEL FOR SMOKERS.

It will be unnecessary to give directions how to use these hot or cold blast smokers, as printed directions accompany all smokers sent out by each manufacturer; but it may be well to allude to the different kinds of fuel that have been used. Rotten wood is good, and accessible to all, but it burns out too rapidly. In the Clark we prefer a kind of stringy sawdust packed solid that comes from the hand-holes made in making hives. Mr. Bingham recommends sound hard wood for his smoker. Dr. Miller and some others prefer turning-lathe hard-wood shavings, or, if these are not available, planer shavings. In certain localities peat can be obtained very cheaply, and it makes an excellent fuel. Some use old rags; others old discarded hive-quilts that are covered with propolis. These last make a very pungent subduing smoke. In some parts of the South, dry pine needles are used. Your locality as well as your own notions will decide what fuel you will use. You want something that will give good smoke, and at the same time be lasting.

HOW TO LIGHT A SMOKER.

To save time in lighting the smoker, our boys use an ordinary spring-top oiler. This is filled with kerosene. After putting the fuel into the smoker we send a few spurts of oil on the fuel, light it, and then we soon have a blazing fire.

Dr. Miller uses prepared rotten wood or cotton rags. These will light readily, and burn under circumstances when other material would go out. His manner of preparing is as follows:

In a gallon of water he dissolves a pound of saltpeter. Into this he drops some dried rotten wood or cotton rags, which are allowed to soak full. Then this material is taken out and dried. This leaves the saltpeter in the fiber of the material, which in consequence is made quite inflammable. The doctor then drops into the smoker some of the saltpeter wood or rags, touches a match to it, and without waiting for it to burn up fills his smoker with dry chips from the chip-yard, planer shavings, greasy cotton waste, or other fuel, when with lively blowing a good smoke is almost immediately produced.

SOLAR WAX-EXTRACTOR. See Wax.

SOURWOOD (*Oxydendrum Arboreum.*) This is considered a great honey-bearing tree in some localities, especially in the

South; but as I have had no personal experience with it, I submit a description from one of our friends who has furnished us with the specimen of the leaves and flowers from which our engraving was made.

The sourwood, sometimes called the sorrel, is a fine tree from 40 to 60 feet in height, and about a foot in diameter; although it sometimes reaches 70 feet in height and a foot and a half through. The popular name, sourwood, is derived from the odor, and the peculiar sour taste of the leaves and small twigs.

SOURWOOD LEAF, FLOWERS, AND SEED-PODS.

It is entirely distinct from the black-gum and sour-gum, or pepperidge, with which it has been unwittingly classed by some writers on honey-plants, much to the injury of sourwood. The former are honey-producers to a small extent, but are not worthy to be compared with sourwood, which, we are convinced after living where basswood, poplar, clover, buckwheat, goldenrod, persimmon, and aster abound, has not its superior among the honey-producing plants of America, either in the amount of yield, or in its beautiful appearance. Basswood is more important, only because of its widely extended growth. We write this article, to call attention more directly to this tree as a honey-producer. Bee-masters are familiar with other flora which abound where those who have written our books on bee culture reside, yet few are aware of the merits of sourwood, outside of the regions where it is found.

We are not familiar with the extent of its growth, but know this much: It abounds in the native forests from Southern Pennsylvania into Georgia and Mississippi. It seems to be more abundant along the whole mountainous tract of country on both sides of the Alleghenies and the Blue Ridge, reaching, in places, even as far as the tide-water on one side, and to Central Tennessee on the other. In many sections where poplar abounds and much buckwheat is raised, sourwood is considered *the honey-plant*, and yields the largest amount of surplus honey. It seems to flourish best on high, dry soil, and often abounds on poor woodland ridges, which can be purchased at a nominal price; though the forests along the rivers, in rich cultivated soil, are often beautifully checkered with the white blossoms in July. Being a tree, the growth is tall and generally spare of branches along the trunk, except when it grows in the edges of fields, where it yields the greatest amount of honey. The trunk preserves its uniformity of size for some distance up from the ground. The wood is white, with straight grain, which splits nicely. It is brittle and quite fine-grained, and is used for posts by cabinet-makers.

The flowers (see engraving) are produced on spikes five or six inches long, which hang in clusters on the ends of branches. Many of these flower-bearing spikes are thrown out from one central spike, and are all strung with white, bell-shaped flowers, rich in honey. The flower is midway in size and appearance between the whortleberry blossom and the lily of the valley. Unless there is a failure of the blossom, the honey-yield is sure to be abundant; for, being in the woods with good roots, the flow is not checked by ordinary droughts, nor do the rains wash out the honey from the pendant, cup-shaped flowers. Often have we regaled ourselves, while riding along the road, by breaking a bunch of the blossoms, shaking out the honey in the hand, and licking up the delicious nectar. It bears no fruit; but each flower, as it dries up, produces a brown seed-pod about the size of a large grain of wheat, which separates, when ripe, into five parts, and permits the very fine seed to fall to the earth.

We omitted to state that the tree commences to bloom the latter part of June, and the harvest from this source lasts until the middle of July.

We are inclined to think that the tree would thrive in our more northern latitudes; perhaps anywhere in our land. It is found abundantly in many parts of the Allegheny Mountains, where it is very cold, the thermometer often indicating several degrees below zero. JAMES W. SHEARER.

Liberty Corner, N. J.

The following is from *Gleanings in Bee Culture*:

SOURWOOD HONEY, ETC.

I send you to-day a sample of sourwood honey. Examine it and let us know what you think of its quality. I get more of it than of any other kind. I took about 800 lbs. last year from the poplar, and something more than 1200 from the sourwood, all extracted.

Now, Mr. Root, nearly all of you bee-men up North say that all pure honey will candy in cold weather; and I want you to keep the sample I send you through the winter, and report if cold weather candies it. I know you have colder weather than we have down here, but I don't believe it will get cold enough to candy sourwood honey.

Lincoln, Tenn., J. F. MONTGOMERY.

You will see under the head EXTRACTED HONEY and SAGE that I do not claim that *all* pure honey will candy. If sourwood honey never candies, it will be a great point in its favor, and I would pay a good price for a barrel of it now, just on account of this one peculiarity. The sample is at hand, and, although it is not as light as our clover and basswood, the color is fair, and the flavor is beautiful. Its aroma is delightful, and has a suggestion of timber and forest-trees.

SPACING FRAMES. In nature we find combs spaced all the way from 1⅜, 1½, 1⅝, and sometimes up to two inches apart, from center to center. Dzierzon, the

first one to conceive the idea of a movable comb, gave 1½ as the right distance until Wyprecht made accurate measurements on straw hives having straight combs built in them. Out of 49 measurements, the average distance was scant 1⅜ inches. Baron von Berlepsch, in 49 other measurements, verified this result. In the United States, prominent apiarists have found the distance of natural-built combs averaged 1½ inches from center to center. It has been observed, that, in the center of the brood-nest, the combs are spaced more closely than those on the outside, the latter ranging anywhere from 1⅜ to 2 inches apart.

It has been urged that we follow nature in the spacing of our brood-frames. But it seems to me that nature is a very poor guide, inasmuch as we find such a diversity of measurements. The bee-keeper should adopt that spacing which will give him the best results—the most brood and the most honey in the surplus arrangements. Quite a number of bee-keepers are using 1½ spacing for their frames. The reason for this is, principally, because they happened to *start* with this spacing. But those who have given special attention to the matter, trying *both* spacings, agree almost uniformly that the right distance is 1⅜, or, if any thing, a trifle scant. Many, indeed, who had fixed-distance frames adapted for 1½ inches, have gone to the enormous expense of changing over to 1⅜. The advantages of this latter spacing are so evident that very few deny that better results may be obtained with it. Brood comb is found to be, on an average, ⅞ inch thick; capped brood, one inch thick. On 1⅜ spacing, this will allow ½ inch between uncapped comb and ⅜ between the capped comb.

The following paragraph I take from an article published in *Gleanings in Bee Culture*, page 673, Vol. XVIII., written by Mr. Julius Hoffman. It applies right here exactly:

If we, for instance, space the combs from center to center so as to measure 1½ instead of 1⅜ inches, then we have an empty space of ⅝ inch between two combs of brood instead of ½, as it ought to be; and it will certainly require more bees to fill and keep warm a ⅝ than a ½ space. In a ½-inch space, the breeding bees from two combs facing each other will join with their backs, and so close up the space between the two brood-combs; if this space is widened, however, to ⅝, the bees can not do this, and more bees will be required to keep up the needed brooding temperature. What a drawback this would be in cool spring weather, when our colonies are weak in numbers yet, and breeding most desirable, can readily be understood.

Where wider spacing is adopted, there is apt to be more honey stored in the combs, and less of worker brood, but more drone brood. Close spacing, on the contrary (1⅜), tends to encourage the rearing of more worker brood, the exclusion of drone brood, and the storage of less honey below. This is exactly as we would have it. I said, there is ½ inch between the uncapped brood. The bees need a little more room in backing in and out of the cells for the purpose of feeding the larvæ than they do after these cells are capped over into sealed brood. Sealed brood, requiring less attention from the bees, and less heat from the cluster, is spaced ⅜ apart, and this is ample. For further hints on this subject, see FIXED FRAMES, HIVE-MAKING, also HIVES.

SPANISH NEEDLE. This plant yields immense quantities of honey along the low bottom-grounds of the Mississippi and Illinois Rivers. The following from GLEANINGS, p. 162, Vol. XVI., is from the Hon. J. M. Hambaugh, and tells all about the plant, and the immense quantities of honey that are often produced by it.

Something over a year ago I wrote a letter for GLEANINGS, claiming that the honey gathered from this plant is superior to that produced from other fall flowers, and that it should rank among the very best grades, and command the same price in the markets as clover and linden honey. My peculiar location has, fortunately, placed me in a position to understand pretty thoroughly the nature of this plant, and the quality of the honey it produces. Located at the foot of the bluffs of the Illinois River, there is a broad expanse of low marshy lands to the east and south, from three to five miles in width. These lands are subject to overflows from the river once a year, which usually take place in early spring. This renders a large portion of the soil unfit for tilling purposes; and the consequence is, the Spanish needle has secured a permanent foothold, almost to the exclusion of all other plants; and early in September they begin to open their beautiful petals, and in a short time whole districts are aglow, and their dazzling brilliancy reminds one of burnished sheets of gold. It is now, should the weather prove favorable, that the bees revel in their glory, and the honey comes *piling in;* and the beauty about this kind of honey is, it needs but little "boiling down," and the bees no sooner fill their cells than they are cured and ready to seal. This is one great advantage, and saves the bees lots of labor, and makes the storage of honey more rapid. I had one colony of bees that stored 63½ lbs. of honey in six days; another one, 86 lbs. in nine days, and 43 producing colonies netted me 2021 lbs. in ten days—an average of 47 lbs. to the colony. This honey, though not quite as clear as clover or linden, is of a golden hue, exquisite flavor, and very fine body, weighing fully 12 lbs. to the gallon, and, as previously stated, I can not see why it should not rank in grade and price on the market with clover and linden honey.

So far as my market is concerned, there is no hon-

ey so universally liked by the consumers as my "golden coreopsis;" in fact, not one word of complaint has ever come back to me from this honey, save one. A neighbor ceased buying it; and when questioned as to why, he stated, "My children eat it up too fast." I am now running a peddling-wagon, and my salesman states he can sell more honey going over territory he has previously canvassed than to hunt up new routes. This certainly speaks well for this kind of honey. I have sold over 4000 lbs. in my home market this season, and the demand seems to be on the increase; and I believe if apiarists will locate their bees so as to get the benefit of these large areas of coreopsis they will not only be conferring a boon on their fellow-man, but will reap a financial reward for themselves. Another word in favor of the coreopsis honey: It is less inclined to granulate; and at this date there is but little sign of granulation, while my two barrels of linden honey is as hard as New Orleans sugar.

J. M. HAMBAUGH.

Spring, Brown Co., Ill., Jan. 21, 1889.

In 1891 Mr. Hambaugh wrote another article on the subject, from which we make the following extract:

The "golden coreopsis," or Spanish needle, stands at the head of all the honey-producing plants with which I have had any experience. It is not only the richest in nectar, but the quality is *par excellence*, and sells in my home market equal to, if not better than, clover honey. Its weight is fully 12 lbs. to the gallon, and it seems to need little if any curing by the bees when gathered. I have never yet seen any crude or unripe Spanish-needle honey, notwithstanding I have extracted it from the same supers three times in two weeks, and on one occasion twice in five and six days. One colony netted 73 lbs. in 5 days, and the apiary of 43 producing colonies, in 8 days, produced 2033 lbs., being upward of 47 lbs. per colony; and this is not true of that particular year only, but it has proven the surest honey-producing plant we have in this locality. Nothing short of cold rainy weather will spoil the harvest from this plant.

SPIDER-FLOWER (*Cleome Pungens*). This belongs to the same family as the ROCKY-MOUNTAIN BEE-PLANT, which it much resembles.

Early in 1878, Mollie O. Large, of Pine Hill Apiary, Millersville, Ill., sent me some seeds, which I had started in a flower-pot, in the house, but transplanted them to the garden some time in May. Aug. 16th they were in full bloom, and the bees were at work upon them; but, strange to say, the blossoms opened only at about sunset; accordingly, after the time when the bees have usually stopped flying, they were seen eagerly hovering over this strange but beautiful plant. The petals, which are of a lovely deep pink, are all on one side of the blossom; and on the other side we see what resembles the long, sprawling legs of the spider. The foliage is also quite ornamental.

In September of the same year, Mrs. Large wrote as follows:

Our experience with the spider-plant, this season, is this: It commenced to bloom about the 25th of June, and the bees have worked on it every fit day since. They commence about 5 o'clock P. M., and work until dark. I used to think bees went home with the sun, but I have heard them on this plant when too dark to see them at any distance, and found them again in the morning as soon as it was light, and for a while after sunrise. If you tie a piece of mosquito-bar over a bunch of the flowers, in the afternoon, and examine it about sundown, you can see the honey for yourself.

MOLLIE O. LARGE.

Pine Hill Apiary, Millersville, Ill., Sept. 11, 1878.

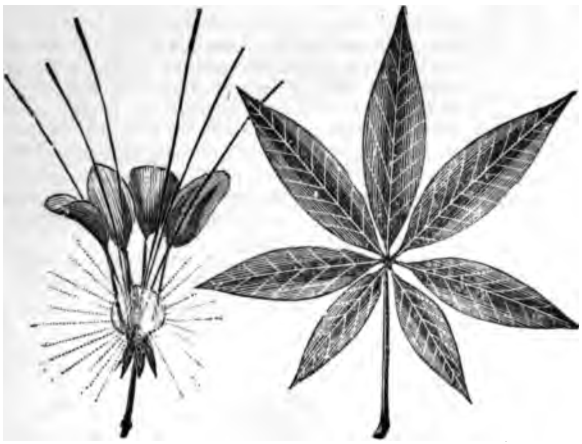
Acting upon her suggestion, we tied a piece of lace over one of the blossoms on our plants, to keep the bees from it, and the drop of honey that collected was so large that I had a fair taste of it.

SPIDER - PLANT.*

One day as late as the 11th of October I got up before 6 o'clock. As I came near the garden, I was surprised to hear a loud humming so early. It was not robbing, but it was a hum of rejoicing. How strange it is, that bees will make this happy hum over the

*The picture above was reproduced from W. Atlee Burpee's catalogue.

honey from the flowers, but never over syrup from any kind of a feeder! The sound led me to the spider-plant. It had been bearing honey a couple of months, at night and early in the morning, but I had no idea that they ever made so much noise over it as now. I approached leisurely, but was startled to



ENLARGED VIEW OF SPIDER-PLANT.

find that each floweret contained a large drop of some liquid, so large, in fact, I thought it must be dew, and not honey. I touched my tongue, and, behold, it was fair honey, of a beautiful limpidity and taste, and then I understood the humming. As a bee alighted, and made its way down between the stamens, I watched until it spread out that delicate, pencil-like tongue, and began to draw in the nectar. Surely no bee can take in so large a drop; and so it proved. It lapped as long as it could and then rested awhile; again it sipped the "sparkling ambrosia," and again it stopped.

It finally spread its wings, and essayed to fly; but its greed had been too great; and when it bumped against a Simpson-plant, which is now out of bloom, down it went on its back in the dirt.

This plant is strikingly like the Rocky-Mountain bee-plant, of which I have given you a picture already. Our engraver has given you a picture of the blossom and leaf of the spider-plant. The picture scarcely needs explanation. On one side is the beautiful leaf of the plant; on the other, one of the flower-stalks, of which there are from 12 to 20 to each plant. As the flowerets, shown in the center, keep blossoming each evening, the stem grows out in the center, until it becomes, finally, two feet long or more, and lined with seed-pods its whole length. These seed-pods, when ripe, break open, and the seed must be gathered daily, or it is lost. Each floweret opens twice, but the honey is yielded only from the first blooming. Our plants are on ground made by piling up the sods taken from where the factory stands; this may, in part, account for the great yield of honey.

MORE ABOUT THAT WONDERFUL SPIDER-PLANT.

One evening we made observations by lamplight; and, before nine o'clock, the globules of honey were of the size of large shot. I was up a little after 5 o'clock, and, with the aid of a teaspoon, I dipped honey enough from 3 or 4 plants to fill a 2-dram vial, such as we used in the queen-cages, a little more than half full. The honey in some of the flowerets had collected in a quantity so large that it spilled out and actually streamed on the ground. With the aid of a lamp I evaporated the nectar down to thick honey. You can see something of what the bees have to do, when I tell you that I had in bulk only about a fifth as much as when I commenced.

After a more extended and thorough trial I will further state that the spider-plant does not yield honey profusely unless it has a deep rich soil. On our creek bottom the stalks made a tremendous growth, and the blossoms were full of nectar; but another plantation, on higher ground, yielded, comparatively, but little honey; and during a dry spell, scarcely any nectar would be found in the blossoms. The Simpson honey-plant has turned out in much the same way.

SPRAYING DESTRUCTIVE TO THE BROOD See FRUIT-BLOSSOMS.

SPREADING BROOD. As is very well known, queens are inclined to lay their eggs in circles in each comb, the circle being larger in the center combs, and smaller in the outside ones. The whole bunch of eggs and brood in several combs thus forms practically a sphere which the bees are able to cover and keep warm. When the queen has formed this sphere of brood and eggs she will curtail her egg-laying for the time being until enough brood is hatched out to increase the size of the cluster; and when that cluster has increased she will gradually

enlarge the circles of brood to keep pace with the ball of bees.

But the queen very often is overcareful—that is, she errs on the safe side; and when warm weather has fully set in she will sometimes lay fewer eggs than she ought to do, in the judgment of the apiarist, and accordingly he inserts a frame of empty comb in the center of the brood-nest. In this comb the queen will commence laying at once to unite, as it were, the two halves of brood; and when she has filled this with eggs the apiarist may insert another empty comb. If the queen has filled the first one given she will be likely, if the weather is not cold, to go into the second comb and fill it with eggs on both sides; for nice clean empty cells are very tempting to her. In a word, this operation of inserting empty combs in the center of the brood-nest is called "spreading brood," and its object is to increase the amount of brood, and thus insure a larger force of workers when the harvest shall come on. While this spreading of the brood *may* be done by practical and experienced bee-keepers, because it stimulates the queen to greater egg-laying capacity, yet when practiced by beginners and the inexperienced it generally results in much more harm than good. An A B C scholar without previous experience might, on a warm day in early spring, think it was high time to put in empty comb in the center of the brood-nest. The queen, we will say, immediately occupies it, filling it with eggs. This, of course, requires a large force of nurse-bees to take care of the young bees and hatching larvæ. A cool spell of weather is almost sure to come on, with the result that the cluster of bees is contracted, leaving the brood that was forced to the outside by the insertion of the empty comb, to be left high and dry where it chills and dies. The outside edges of the cluster, in its effort to take care of this brood, is chilled, with the result that the colony suffers a check and a setback that is far worse than if it had been left to its own devices.

Ordinarily we may say that the spreading of brood may be practiced safely only after settled warm weather has come on. The beginner, if he desires to give extra comb for egg-laying, especially in the spring, would do well to put those combs on the *outside;* but after settled warm weather has come on, and the temperature does not go below 40 degrees Fahrenheit at night, at any time, he may insert a frame of empty comb in the center of the brood-nest.

But it should be borne in mind that the spreading of brood is a practice that has been largely abandoned, even by experienced bee-keepers. If the queen has plenty of room somewhere in the brood-nest (and that "somewhere" should be outside of the brood-cluster), the bees and the queen will ordinarily rear as much brood as they can safely and profitably take care of.

SPRING DWINDLING. See WINTERING.

STINGS. It is true, that bees can not bite and kick like horses, nor can they hook like cattle; but most people, after having had an experience with bee-stings for the first time, are inclined to think they would rather be bitten, kicked, and hooked, all together, than risk a repetition of that keen and exquisite anguish which one feels as he receives the full contents of the poison-bag, from a vigorous hybrid, during the height of the honey-season. Stings are not all alike, by any means; and while I can stand the greater part of them without even wincing, or stopping my work, I *occasionally* get one that seems as if it could not possibly be borne. As I always find myself obliged to bear it, however, I try to do so as best I can.

I have often noticed that the pain is much harder to bear if I stop and allow my mind to dwell on it; or after being stung, if I just think of former times when I have received painful stings, at the mere thought a sudden pang darts along the wounded part. I do not know why this is, unless it is the effect of the imagination; if so, then it is clear to my mind that even imaginary pains are very hard to bear. I have sometimes purposely, by way of experiment, allowed my mind to dwell on the pain of the sting the moment it was inflicted, and the increase would be such that it would almost make me scream with pain. If you doubt this, the next time your feet get very cold, just think of wading barefooted in the frozen snow, at a zero temperature. Perhaps my imagination is unusually active, for it sometimes makes the pain, when riding in the cold, almost unbearable, while I get along very well if thinking of something else. Well, if others have had a similar experience, and I presume you all have, you can see why I have so often given as a remedy for stings, simply keeping on with your work, and paying no attention to the stings whatever.

Of course, where stings swell on one so badly as to shut an eye, or the like of that, I presume you might be obliged to stop work

awhile; but even then, I would advise paying as little attention to the matter as it is possible to do, and by all means to avoid rubbing or irritating the affected part. I have known stings to be made very painful by rubbing and fussing with them, which I have good reason to think would have given little if any trouble otherwise. You all know that when you get warmed up with hard work, a bruise, a bump, or a slight flesh wound, gives little if any pain; but to sit down calmly and cut into one's flesh gives the most excruciating pain. When a lad, I have repeatedly cut great gashes in my fingers with my jack-knife, and felt but little pain at the time; but when it became necessary to lance the flesh to get a sliver out of the foot, or to cut open a stone-bruise, the pain was the most intense I can imagine. To pare away with the razor until you get through the skin, and see the blood start—why, it makes my flesh creep to think of it now; but the clips that came unawares with the dull jack-knife were scarcely heeded at all, more than to tie up the wound to keep the blood from soiling my work.

"OU-OO-OW-OO-O-U-C-H!!"

Well, the point is, we are to take stings just as we used to take the cuts with those jack-knives, in our boyhood days. Of course, we are not to rush needlessly into danger; but when it comes, take it philosophically. I would pull the sting out as quickly as possible, and I would take it out in such a way as to avoid, as much as possible, squeezing the contents of the poison-bag into the wound. If you pick the sting out with the thumb and finger in the way that comes natural, you will probably get a fresh dose of poison in the act, and this will sometimes prove the most painful of the whole operation, and cause the sting to swell when it otherwise would not have done so.

I have sometimes thought it might be nearly as well to leave the sting in the wound. I have frequently found them when washing, and the presence of the sting was the first indication I had that I had been stung; but I presume I knew at the time that a sting had been inflicted.

THE PROPER WAY TO REMOVE A BEE-STING.

The blade of a knife, if one is handy, may be slid under the poison-bag, and the sting lifted out, without pressing a particle more of the poison into the wound. When a knife-blade is not handy, I would push the sting out with the thumb or finger nail in much the same way. It is quite desirable that the sting should be taken out as quickly as possible, for if the barbs (to be described further along) once get a hold in the flesh, the muscular contractions will rapidly work the sting deeper and deeper. Sometimes the sting separates, and a part of it (one of the

splinters, so to speak) is left in the wound; it has been suggested that we should be very careful to remove every one of these tiny points; but after trying many times to see what the effect would be, I have concluded that they do but little harm, and that the main thing is, to remove the part containing the poison-bag, before it has emptied itself completely into the wound. When I am very busy, or have something in my other hand making it inconvenient to remove the sting with my knife or finger-nail, I have been in the habit of rubbing the sting out against my clothing, in such a way as to push the poison-bag off sidewise; and although this plan often breaks off the sting so as to leave splinters in the wound, I have found little if any more trouble from them than usual.[191]

REMEDIES FOR BEE-STINGS.

For years past I have taken the ground that remedies of all kinds are of so little avail, if of any avail at all, that the best way is to pay no attention to any of them. This has awakened a great deal of arguing, I know, and the remedies that have been sent me, which the writers knew were good, because they had tried them, have been enough to fill pages of this book. I have tried a great many of them, and, for a time, have imagined they "did good;" but after giving them a more extended trial, I have been forced to conclude that they were of no avail. Nay, further: they not only did no good, but if the directions with the remedy were to rub it in the wound, they did a positive harm; for the friction diffused the poison more rapidly into circulation, and made a painful swelling of what would have been very trifling, if let alone. Please bear in mind that the poison is introduced into the flesh through a puncture so minute that the finest cambric needle could by no manner of means enter where the sting did, and that the flesh closes over so completely after it, that it is practically impossible for the remedy to penetrate this opening; now, even if you have a remedy that will neutralize the poison, in something the same way that an alkali neutralizes any other acid, how are you to get it in contact with the poison? I know of no way of doing it, unless we resort to a surgical operation; and if you will try that kind of "tinkering" with one bee-sting, you will probably never want to try another. I tell you, there is no remedy in the world like letting it alone, and going on with your work without even thinking about it. But, suppose we get a sting under the eye, that closes up that very important organ; shall we go on with our work still? Well, I believe I would go on with my work still, and do the best I could do with one eye. If both were closed at once, I do not know but I would wait awhile until they should get open again. I would not resort to medicine and "tinkering," even then, but would let the eyes alone, until they came open of themselves.

If the wound is feverish, or if a person has received a great number of stings at one time, an application of cold water, or cloths wet in cold water, may prove a relief; but even in using this simple means, I would lay the cloth on very quietly, and carefully avoid rubbing or irritation. I have often dipped

"GO'VAY, YOU BEE!"

my hand in cold water after having a painful sting; but as my hand ached just as bad under the water (it really ached worse, because I had nothing else to do but to stand there and think about it), I soon dropped that remedy also. A year or two ago kerosene oil was suggested as a remedy, and two of our friends regarded it of such importance that they almost got into a controversy about which was entitled to the honor of the discovery. Well, I had a very bad sting on my hand, and I went for the oil-can, and dropped

oil on the spot for some time; as kerosene will remove a rusty bolt or screw when nothing else will avail, and as it seems to have a wonderful power of penetrating all cracks and crevices, I began to have faith that it might follow the sting of the bee, and in some way neutralize the poison. I had the satisfaction of having one of the most painful and lasting stings I ever got; and, together with the offensive smell of the oil, it quite sickened me of that, as a remedy. I presume the oil made it no worse, but it really seemed to me that it must have done so.

WHAT TO DO WHEN STUNG A GREAT NUMBER OF TIMES, ALL AT ONCE.

Severe cases of stinging are usually the result of carelessness, either from allowing combs to be scattered, causing robbing, or because a hive has been bumped over by careless driving, or by some animal allowed the range of the apiary. There are a number of cases on record where horses have been stung to death; and it is hardly safe to allow such animals the freedom of the apiary, although cows and sheep will cause very little trouble. Mr. Chalon Fowls, of Oberlin, O., left a horse hitched near some hives of what he thought were gentle Italians; but by some means or other the animal bumped one of the hives, irritating the bees, causing them to rush out and sting. The horse, of course, began to plunge and kick, with the result that he demolished completely all the hives within reach. Mr. Fowls said the horse, when he could get to him, was almost literally covered with stings. He unhitched him and immediately called for a boiler of hot water. This was brought out as soon as it could be heated. Cloths and blankets were immersed in water, almost boiling hot, wrung almost dry, and laid over the animal, now writhing in the severest agony. The moment Mr. Fowls applied the hot blankets he says the horse quieted down. During the escapade he himself was terribly stung in the face and on the hands; and he says that, as soon as the hot cloths were applied to his face, he felt almost instant relief. The hot cloths were applied to the horse on every portion that was stung, and Mr. Fowls had the satisfaction of knowing that he could save his horse, which was soon as well as ever.

Cases are on record of severe stinging of human beings where cold applications were used instead of hot, with almost as good results, apparently. In such cases the patients are wrapped in a bed sheet, wrung from cold water, and put to bed, and applications renewed until relief followed. I have never been severely stung myself; but I believe there is more efficacy in *hot* applications than in cold; and I would recommend that, in case of severe stinging, such be tried.

During the summer of 1902 at one of our outyards we had an experience which we thought at the time would be fatal to both man and beast. It came about somewhat in this way. A neighbor of ours who had a field of timothy near our yard had allowed his horse to eat grass within a few feet of the yard while he went to the further end of the field to look after some work. In the mean time the horse had managed to get over among the bees. The result was, she knocked over five hives, and was literally covered with stings when our neighbor came up. Being a practical bee-man as well as a horse-man himself, he rushed into the fray, freed the horse, and started her for the barn. The animal was beginning to swell badly, and it was evident to him that she would die before relief could be given by a veterinary, even if called. He accordingly rolled up about a pound of common table salt in a paper, opened the animal's mouth, and with the left hand grabbed her tongue, pulling it out as far as he could. He then with his right hand shoved the salt clear down her throat, reaching to his elbow. This done, he quickly closed her mouth and elevated her head until he saw the wad of salt go down the gullet. In a short time the horse showed relief, for the salt probably neutralized, to some extent, the effect of the acid poison. It also acted as a physic; for if a horse is sick at the stomach he can not vomit, and it is necessary to give him something at once to keep the bowels free. In three or four hours the horse was as well as ever.

Our neighbor did not apply wet blankets wrung out of hot water; but the veterinary, whom we consulted afterward, said that the giving of the salt was one of the best things that could have been done, and added that he would have wrapped the animal up in a blanket wrung out of hot water. If to this water was added a small quantity of ammonia, all the better. I suggest, then, if a horse is badly stung, it be given a dose of common salt, and be treated to applications of hot blankets, and that the blankets should be renewed often. If hot water can not be obtained, use cold.

GETTING HARDENED TO THE EFFECTS OF STINGS.

When I first commenced bee-keeping, stings swelled so badly, and were so painful, that I had either my hands or eyes swelled up most of the time, and I seriously contemplated giving up the business, just on this account alone. After I had had a little more practice, I discovered that there was very little need of being stung at all, if one was careful not to provoke the ire of the little insects. Still further, I found the swelling to be gradually less and less; and before my first summer was over, I very seldom felt the effects of any sting, the day afterward. When first commencing, if my eye was swelled so as to be closed by a sting, it often took until the third day to have it go down entirely. The A B C class, almost without exception, corroborate this experience.

HOW TO AVOID BEING STUNG.

Some may imagine, from the foregoing, that it is necessary for one who keeps bees to submit to the pain of being stung several times every day. A short time ago a lady said that she could never stand it to have her husband keep 100 colonies, for she got stung four or five times a day with only a dozen, and 30 or 40 stings a day would be more than she could possibly bear. Now, my friends, I think I can take any one of you into an apiary of 100 colonies, and have you assist me all day long, without your getting a single sting. Nay, further: if you are very timid, and cannot bear a single sting, by taking some pains you may be able to work day after day, without being stung. The apiary must be properly cared for, and no robbing allowed, and you must do exactly as I tell you. See ANGER OF BEES. It may be a hard matter to tell you in a book how to behave without being stung, but I will try. In the first place, avoid standing right in front of any hive. I am often very much tried with visitors (some of them bee-keepers, too, who ought to know better), because they will stand right before the entrance until they have a small swarm scolding around them because they cannot get out and in, and then wonder why so many bees are buzzing about in that particular spot.[193] If you should go into a factory, and stand in the way of the workmen until a dozen of them were blocked up with their arms full of boards and finished work, you would be pretty apt to be told to get out of the way. Now, you are to exercise the same common sense in an apiary. By watching them you can tell at once their path through the air, and you are to keep out of their way. Right back of any hive is a pretty safe place to stand.

One of the first things to learn is to know whether a bee is angry or not, by the noise it makes. It seems to me you should all know by the hum of a bee, when it is gathering honey from the heads of clover in the fields, that it has no malice toward any living thing; it is the happy hum of honest industry and contentment. People sometimes jump when a bee hums thus harmlessly along, and it seems to me they should know better, but I presume it is because bees are not in their line of business, and they don't know "bee talk."

Well, when you go in front of a hive, or even approach hives that are not accustomed to being worked with, one of the sentinels will frequently take wing, and, by an angry and loud buzz, bid you begone.[194] This note is quite unlike that of a bee upon the flowers, or of the ordinary laborer upon the wing; it is in a high key, and the tone, to me, sounds much like that of a scolding woman, and one who will be pretty sure to make her threats good if you do not heed the warning. When one of these bees approaches, you are first to lower your head, or, better still, tip down your hat-brim; for these fellows almost always instinctively aim for the eyes. It will often be satisfied, and go back into its hive if you move away a little; but you must be sure not to give it to understand that you admit yourself a thief, and that it has frightened you. If it gets very threatening, and you are timid, you would better go into some building. I am in the habit of opening the door of the honey-house, and asking visitors to go in there, when an angry bee persists in following them. Very many times I can hardly get them to go in as I direct, because they can not see why the bee will not follow them, and thus have them cornered up and a sure prey. I do not know why it is, but a bee very seldom ventures to follow one indoors. A single bee never does, if I am correct; but a very vicious colony of hybrids, when fully aroused, may do so.[195]

WHAT TO DO WHEN A SINGLE BEE FOLLOWS YOU ABOUT BY THE HOUR.

It not unfrequently happens, especially in an apiary where there are hybrids, that a single bee (of this race) will follow you about the apiary for hours, poising itself just before your eyes, making believe to sting. It does not pay to be humane with such bees. While your offender is holding itself aloft before your

face in a menacing manner, smash it between your hands, or, with a stick, give it a smart rap; but take care that you don't miss it, or it will stop its dallying and deliver its sting.[196] In the use of the stick, it is quite useless to strike at individual bees on the wing. It is my plan to take up two sticks, or any thing that is handy, say an inch or two wide and a foot or two long. With a couple of these, one in each hand, I make a rapid whirling in front of my face, revolving the sticks back and forth. This excites the ire of the cross bees, causing them to rush right out at the rapidly moving objects, with the result that they get their heads rapped right and left. I have had at various times perhaps a hundred bees buzzing about my head, and yet I have killed them all, in the manner I have explained, in less time than it takes to tell it. Such bees, unless killed, will harrass one for perhaps an hour.

HOW TO SAVE YOURSELF FROM A STING.

Sometimes a bee will be in the act of inserting its sting in your hand. If the other hand is not holding a frame, or is not otherwise engaged, bring it to the rescue by smashing the bee before it succeeds. If, as is sometimes the case, the other hand is holding a frame, slap the hand which is being attacked, against your person. If you do it right you can both smash the bee and also rub out the sting, if its owner has succeeded in plunging it into the flesh. Never slap the hand directly against yourself, but give it a sort of sliding-motion. You will thus accomplish the double purpose. If a bee strikes you in the back of the neck (and you have no veil on), lodging in your hair, smash it by that half-slap and half-rubbing motion. I recommend killing bees as above, when they have actually begun to insert their sting, because they are then, so far as I am able to observe, determined to accomplish their purpose or die. If it is in my power, I usually prefer to have them do the latter; for if a bee is foiled after it has got so far, it will carry out the principle most persistently of the little adage, "If at first you don't succeed," etc. See ANGER OF BEES.

Where there has been no robbing going on, one has usually warning enough, and in ample time, to take precautions. Where the bees are quietly at work, that is, during the working season, there is but little danger from bees in the air. When you are working with a hive, bending right over the uncovered frames, you are comparatively secure from the bees of other hives; for when there is no robbing, bees seem to have no disposition to meddle or hang around their neighbors' homes. This is one reason why bystanders, or those who are off at a little distance, are so much more apt to be stung than the apiarist who is right among them.

JERKING THE HANDS BACK.

A good many times, especially if the bees are inclined to be a little cross, three or four, as you proceed to lift the frame, will strike against the hands as if about to sting. The natural tendency, of course, is to jerk the hand back. This is the worst thing that you can do. You will be almost sure to be stung then, while, if you hold your hands motionless, and let the bees see that the new objects are not afraid of them, they will rarely if ever go beyond a pretense of using their weapon. I am sure that a large number of stings received by beginners on the hands are attributable to this jerking-back of the hands. The same is true with reference to the face, if not protected by a veil. Nine-tenths of the bees which make such demonstration will not sting, if you can control your nerves, letting your tormentors know that you are not to be frightened.

HOW TO OPEN A HIVE, WITHOUT BEING STUNG.

Have your smoker lighted, and in good trim, and then set it down near the hive you are going to work with. Now, I would never use smoke with any hive of bees, unless they need it to subdue them; for why should we disturb and annoy the little fellows while quietly going about their household duties, unless we are obliged to? I frequently open hive after hive, with no kind of use for smoke at all, and yet I often see bee-keepers drive the poor little chaps down to the bottoms of their hives with great volumes of smoke, when they have not shown the least symptom of any disposition but the most friendly one. It is true, where the colony is very large, the bees sometimes pile up in the way, on the rabbets and ends of the frames, so that it becomes desirable to drive them away for their own safety. For this purpose, very little smoke is needed; and if you are in no great hurry, they will clear out of the way, if you just pat them on the backs gently with a weed or bit of grass.[197] If the bees are disposed to be cross, and to show fight, you will readily discover it the minute you turn up the first corner of the cloth covering; and if it takes smoke to make them beg pardon, give them smoke, but only in small quantities until you are sure more

is needed. See **Frames, How to Manipulate.**

WHAT KIND OF BEES STING WORST.

The general decision is, that the pure Italians are, as a rule, the most easily handled.* Not only do they sting less, but as they keep their places on the combs without getting excited, when hives are properly opened,

they are far less liable to get under one's clothing than the common bees. A great many stings are received from bees that are in no way badly disposed at all, simply by their getting pinched accidentally, while on the person of the bee-keeper. Pure Italians may be handled all day, with no such mishap; but after working among blacks or hybrids, I often find a dozen or more under my coat, up my sleeves, if they can get up, and, worst of all, up my trousers, if I have not taken the precaution to tuck them into my boots, or stockings when I wear low shoes. See Bee-dress. Well, I believe this one thing alone would decide me in favor of the Italians, if they were simply equal to the blacks in other respects. The hybrids, as I have before stated, are much worse to sting than either of the races when pure; and the Cyprian and the Holy-Land bees are much worse still, and sometimes smoke has no effect on them. See Cyprians, under Italians.

It may be well to add, that we find many exceptions to these rules; a hive of blacks will sometimes be much easier to handle than a hive of Italians in the same yard, and the progeny of a queen that we may have every other reason to call pure, may be as cross as the worst hybrids. Still further: A very cross colony of bees may be so educated, by careful treatment, as to become very gentle, and *vice versa.* The colony in front of the door of the honey-house was always a gentle one, season after season; the explanation of it is, that they become accustomed to the continual passing and repassing of the bee-keeper in front of their hive, and learned to be dodging past some one almost all the time. On the contrary, those bees that are in the remote corners of the apiary are very apt to sting you, if you just come round to take a view of their entrance. The Egyptian bees are said to be very much worse than any of the other races; and as they do not yield to smoke, as do others, they have been discarded, principally on account of this unpleasant feature.*

THE BEE-STING POISON.

When bees are very angry, and elevate that portion of their bodies containing the sting, you will often see a tiny drop of some transparent liquid on the point of the sting. This liquid is the poison of the bee-sting. It has a sharp, pungent taste; and when thrown in the eyes, as often happens, it has a stinging, acrid feeling, as if it might be a compound of cayenne pepper, onion - juice, and horseradish combined; and one who tastes it or gets it in his eyes concludes it is not so very strange that such a substance, introduced into the circulation, produces such exquisite pain. The poison of the bee-sting has been shown to be similar in composition to that of the viper and scorpion; but at the present writing I can not learn that any chemist has ever given us an analysis that would tell us just what the poison is. The acid obtained from ants is called formic acid, and I have wondered whether that from bee-stings is not similar, if not the same. It is probably a vegetable acid, secreted from the honey and pollen that constitutes their food, and it is well known that the poison is much more pungent when the bees are working in the fields, and accumulating stores largely, than it is when they are at rest in the winter months. It is generally during basswood-bloom that we get those severe stings which draw the blood and show a large white spot around the wound.

*Queenless bees are almost always much worse; it may be because they seldom work with energy, and have therefore no fresh accumulation of stores, that tend so much to put bees on their good behavior.

*Carniolans have the reputation of being very gentle, but I think are no more so than Italians.

HOW IT IS DONE.

It is quite an interesting experiment to let a bee sting you on the hand, and then coolly observe the whole performance, without disturbing it. When a boy wishes to jump across a brook, he usually goes back a few feet, and takes a little run; well, a bee, when it introduces the point of its sting, prefers to make a short run or dash, or it may fail in lodging the barbs of the sting securely in the flesh. I do not believe a bee can very well get up the necessary energy to sting unless it is under the influence of some excitement. I have sometimes, in trying to see how far I could go with an angry colony of bees without the use of smoke, had a lot of them strike my face with a sudden dash; but as I kept perfectly still, they would alight without stinging. Now, the slightest movement, even an incautious breath, would result in some pretty severe stinging; but if I kept cool and quiet, and carefully walked away, I might escape without any stings at all. Very often a single bee will work itself up to a sufficient passion to try to sting; but to commence while standing still, I have always found to be rather difficult work for them; and although they sometimes prick slightly, and give one a touch of the poison, they seldom sting very severely, without taking wing again. To go back: After the bee has penetrated the flesh on your hand, and worked the sting so deeply into the flesh as to be satisfied, it begins to find that it is a prisoner, and to consider means of escape. It usually gets smashed at about this stage of proceedings, unless it succeeds in tearing the sting — poison-bag and all —from the body; however, if allowed to do the work quietly it seldom does this, knowing that such a proceeding seriously maims it for life, if it does not kill it. After pulling at the sting to see that it will not come out, it seems to consider the matter a little, and then commences to walk around it, in a circle, just as if it were a screw it was going to turn out of a board. If you will be patient and let it alone, it will get it out by this very process, and fly off unharmed. I need not tell you that it takes some heroism to submit patiently to all this manœuvring. The temptation is almost ungovernable, while experiencing the intense pain, to say, while you give it a clip, "There, you little beggar, take that, and learn better manners in future."

Well, how does every bee know that it can extricate its sting by walking around it? Some would say it is instinct. Well, I guess it is; but it seems to me, after all, that it "sort o' remembers" how its ancestors have behaved in similar predicaments for ages and ages past.

ODOR OF THE BEE-STING POISON.

After one bee has stung you, if you use the hand that has been stung among the bees in the hive, the smell of the poison, or something else, will be pretty sure to get more stings for you, unless you are very careful. Also after one sting has been inflicted, there seems a much greater chance, when about in the apiary, of getting more stings. Mr. Quinby has suggested that this is owing to the smell of the poison, and that the use of smoke will neutralize this scent. This probably is so, but I am not fully satisfied of it.

THE POISON OF THE BEE-STING AS A REMEDIAL AGENT.

For some years past there have been running through our journals many reports in regard to the agency of bee-stings in the cure of certain forms of diseases, especially rheumatism. From the facts put forth, I think any candid reasoner will have to admit that being stung frequently does certainly have the effect of relieving certain forms of rheumatism, paralysis, and perhaps dropsy. It is true, the open-air exercise may have something to do with it; but I believe the poison of the sting itself often gives almost immediate relief in the diseases above mentioned. I may add here, that it is well known that homeopathists use bee-sting poison as a remedial agent, under the name of *Apis mellifica*. In their hands it is one of the most useful of all remedies in the treatment of œdematous and dropsical conditions of the cellular tissue, skin, serous and mucous membranes, and the glandular system. The late C. F. Muth, of Cincinnati, sold a good many colonies of live Italians to doctors, for the sole purpose of extracting the poison. If I am correct, they extract the poison by means of alcohol. We have also sold bees by the pound for the same purpose. During the summer of 1889 we furnished 10,000 stings to a prominent pharmaceutical establishment, and have since furnished stings in smaller lots for other parties.

DOES A BEE DIE AFTER LOSING ITS STING?

It has been stated that the loss of the sting results in the death of the bee within a very few hours; but this can hardly be true. Colonies have at times become so enraged as to sting every thing within reach, even plunging their little javelins into fence-posts and other inanimate objects, the result being

that nearly every bee of the colonies in the fracas would lose its sting, and yet these same colonies live and prosper. One correspondent in particular relates the following incident:

Through a piece of carelessness he allowed a certain one of his colonies to become so infuriated as to sting everybody and every thing within their reach. He declared, upon a subsequent examination, that there was scarcely a bee in that whole colony which did not show unmistakable evidence of having lost its sting in the uproar just mentioned. Now, the singular fact was that these bees actually lived, gathered honey, and prospered.

That *some* bees may die after losing their sting, may be true; but that they universally do so is a myth that is now thoroughly discredited.

SMOKE NOT ALWAYS A PREVENTIVE OF BEE-STINGS.

Although smoke is our great reliance as a security against stings while working among bees, there are sometimes colonies, or seasons of the year, I scarcely know which, when one can get along better without it. I remember trying to open a colony of hybrids in the fall of the year, to show them to my wife. As a safeguard, I first gave them a good smoking; but, to my surprise, they got into a perfect panic, and poured out of the hive and showed fight, in great numbers. It is true, I could drive them down; but the minute I ceased smoking them, to lift out a comb, they became perfectly infuriated; and although driven down to the bottom-board repeatedly, they were up and ready for an attack, almost as soon as the smoker was turned away from the hive. I let them go, without half making the examination I wished. The next day, in passing the hive I thought I would look in and see if they were of the same opinion still. I had no smoker, and so raised the corner of the cloth over the frames cautiously. They kept on with their work, and seemed to care nothing about the intrusion. I took the cloth clear off, lifted frame after frame, but not a bee showed the least sign of hostility. In surprise, I carried a frame with the queen on it into the house and showed it to my wife, and told her it was the same swarm that acted so wickedly, just the day before. The only trouble seemed to be that they very decidedly objected to having their hive deluged with the offensive smoke, and I am sure it must be very painful to them in its effects. I took the lesson, and have since often found that I could get along even better without smoke. Have your smoker in readiness; and if you are obliged to use smoke, use a very little, as circumstances seem to decide best. Sometimes the only way seems to be to use it in considerable quantities, but I would never smoke the poor little fellows needlessly.[201]

MECHANICAL CONSTRUCTION AND OPERATION OF THE STING.

After a bee has stung you, and torn itself away from the sting, you will notice, if you look closely, a bundle of muscles, near by and partly enveloping the poison-bag. Well, the curious part of it is, that, for some considerable time after the sting has been detached from the body of the bee, these muscles will work with a kind of pump-like motion, working the sting further into the wound, as if they had a conscious existence, and burned with a desire to wreak vengeance on the party attacked. Nay, further, after the sting has been pulled from the flesh, and thrown away, if it should stick to your clothing in such a way that your flesh will come in contact with it, it will commence working again, pulling itself into the flesh, and emptying the poison into the wound, precisely as if the living bee were itself working it. I have been stung a great many times from a sting without any bee about it at all. Without any precise figures, I should say a sting would hold life enough to give a very painful wound, as long as full five minutes; and it may be, in some cases, even ten minutes.*[575] This phenomenon is wonderful, and I have often, while watching the sting sink into the rim of my felt hat, pondered on that wonderful thing, animal life. Why should that isolated sting behave in this manner, when the bee to which it belonged was perhaps far away, buzzing through the air? Why should this bundle of fibers and muscles behave as if it had a life to throw away? I do not know. This, however, I do know; when you pull a sting from the wound, you should throw it far enough away so that it will not get back on your face or hands, or into your hair, to sting you again.

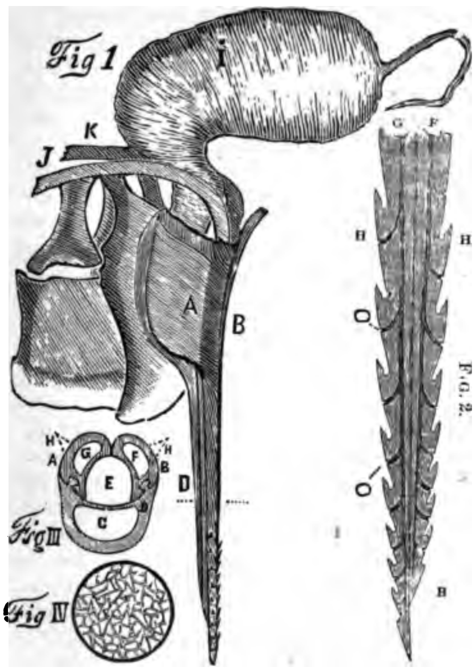
In giving the following description of a bee-sting, I am much indebted to the drawings and description given by J. R. Bledsoe, of Natchez, Mississippi, in the *American Bee Journal* for August, 1870. I am also indebted to Prof. Cook's excellent Manual.

Under the microscope the sting is found

*Muscular contraction of the sting has taken place under the field of the microscope 20 minutes after being detached from the bee.

to be a beautifully fashioned and polished instrument, whose delicate taper and finish make a most surprising contrast with any instrument man has been able to produce. In shape it appears to be round; but it is, in reality, egg-shaped, and is of a dark-red color, but transparent enough so that we may see the hollow that runs through the center of each of its parts. These hollows are probably to secure lightness as well as strength.

I have given you three views of the different parts of the sting, like letters representing like parts in all. Bear in mind that the sting proper is composed of three parts—the outer shell, or husk, D, and two barbed spears that slide partly inside of it. In Fig. 2 I have shown you the spears. The barbs are



BEE-STING MAGNIFIED.

much like the barbs on a fish-hook; and when the point of one spear, A, penetrates far enough to get one barb under the skin, the bee has made a hold, and has no difficulty in sinking the sting its whole length into the wound; for the pumping motion at once commences, and the other spear, B, slides down a little beyond A, then A beyond B, and so on. The manner in which these spears are worked is, as nearly as I can make out, by a pair of something like pump-handles, operated by small but powerful muscles. I have shown you the arrangement of these handles at J and K, Fig. 1, as nearly as I could conjecture what it must be, from watching its workings under the microscope. These muscles will work, at intervals, for some time after the sting has been torn from the bee, as I have explained. They work with sufficient power to send the sting through a felt hat, or into a tough buckskin glove. I have often watched the bee while attempting to get its sting started into the hard cuticle on the inside of my hand. The spears will often run along the surface diagonally, so that you can see how it works down by successive pumps. The hollow in these spears is indicated at G and F, in Figs. 2 and 3; O, O, ducts leading from G and F.

I am not certain as to what the real office of these ducts, O, O, is. I have sometimes thought that they were for the purpose of conducting the poison to the wound from the canals G and F, the latter communicating directly with the poison-bag itself. Indeed, Frank Cheshire says they afford the only means of exit for the poison, and he is probably right.

Fig. 3 is a transverse section, sliced across the three parts, at about the dotted line D. A and B are the barbed spears; F and G, the hollows to give them lightness and strength; H, H, the barbs. It will be observed that the husk, D, incloses but little more than ⅓ of them. Now, the purpose of this husk is to hold the barbs in place, and to allow them to slide easily up and down, also to direct them while doing this work. To hold all together, there is a groove like a chopping-knife in both spears, and a corresponding projection in the husk, which fit each other, as shown. This allows the barbs to project to do their work, and yet holds all together tolerably firm. I say tolerably firm, for these spears are very easily torn out of the husk; and after a sting is extracted, they are often left in the wound, like the tiny splinters I have before spoken of. When torn out and laid on a slip of glass they are scarcely visible to the naked eye; but under the microscope they show as seen in Fig. 2.

Stings do not all have the same number of barbs. I have seen as few as 7 and as many as 9. The two spears are held against each other as shown in Fig. 3, and you will observe that the shape and the arrangement of the 3 parts leave the hollow, E, in their center. The hollows are the channels for this wonderful vegetable poison. The working of the spears also pumps down poison, and quite a good-sized drop collected on the points of the spears while I saw them work-

ing under the microscope. Friend Bledsoe found a valve that let the poison out of the poison-bag into this wonderful little pump, but prevented it from returning. I have not been able to see this, but have no doubt that it is there. The drop of poison, after it has lain on the glass a few minutes, dries down, and seems to leave a gummy substance, that crystallizes, as it were, into strange and beautiful forms. I have tried to show it to you in Fig. 4.

I can not close the subject of stings without speaking of the wonderful similarity between the mechanism of the sting of the bee and the apparatus furnished many insects for sawing and boring into wood and other substances, for the purpose of depositing their eggs. Almost precisely the same apparatus is used, but the barbs on the extremities are saws instead of the sharp hooks. If you will look at the cut you will see that but very little change need be made in these barbs to convert them into saw-teeth, and then we should have an engine for cutting and boring holes, that might easily be patented if old Dame Nature were so disposed. Now listen. If the insect had but one saw, even though it had strength to draw it back and forth, its light body would not give it purchase enough to do much execution with it. It is true, it might "dig in its toe-nails," and hold itself down so that it could work it to some extent; but then it could not change its position according to its work, etc. When the saw was worked, instead of its cutting into the hard timber its light body would be simply slid to and fro; but with two saws, like the barbed spears of the bee-sting, working in a sheath to hold them together, it can stand its ground and use its enormous muscular strength to do rapid cutting, even if its body does weigh only half a grain, or less. While one saw goes forward, the other goes backward; and the rapidity with which these insects work them enables them to make astonishing progress, even in substances so hard that one would not suppose they could make any impression at all. Now here comes in again the wonderful law I have spoken of so many times, on these pages. The insect that has the most effective and perfect set of tools will lay most eggs and have them most secure from the depredation of enemies, and its species will stand a better chance of survival than the individual or class with poorer tools. By giving a constant preference to the best workers, and taking into account how nature sports and varies, would it be strange if, after the lapse of ages, the result should be the beautifully finished work we see through the microscope? I do not know that bee-stings could develop into saws, or saws into bee-stings; but if an insect should be found using its ovipositor as a weapon of defense, as well as for the purpose of egg-laying, it might look as though the thing were possible. I am not an entomologist, and I do not know that any such insect has ever been discovered. Who will enlighten us?

SUMAC (*Rhus*). This is a sort of shrub, or small tree, readily known by its bunches of bright red fruit, having an intensely sour taste. The acid property, however, seems to be only on the surface of the fruit, in the red dust that may be brushed off. I have had no experience with the honey, which the bees sometimes get in large quantities from the small greenish flowers, but give the following from page 96, GLEANINGS for 1874:

June 22, 1874.— Contrary to expectations, we are now in the height of a wonderful flow of honey from sumac, which of late years has not yielded much. Every thing in the hives is filled full, and I am kept busy hiving swarms, as it has become too much of a job to keep them from swarming by removing frames of brood. G. F. MERRIAM, Topeka, Kan.

SUNFLOWER (*Helianthus*). This plant embraces a very large family; but the principal ones for honey are the common sunflower and the Jerusalem artichoke. During some seasons and in some localities the bees seem to be very busy indeed on these plants, all the day long. The mammoth Russian sunflower bears flowers of enormous dimensions; and from the way the bees crowd each other about the nectaries, one would suppose they yielded much honey.[579] The seed, which is yielded in large quantities, would seem almost to pay the expense of cultivation. The following is taken from page 36, Vol. III., of GLEANINGS:

My boy had a small box of sunflower seeds, which he kept as one of his playthings. Last spring he accidentally spilt them in the garden by the fence, and, old as they were, they came up profusely. They looked so thrifty, I took it into my head to transplant them. I set them all around in the fence, out of the way, where nothing else would grow to advantage, and, if you will believe me, I had an enormous crop. When they blossomed the bees went at them in earnest; and after the bees got through with them there were several quarts of seed. I sold a dollar's worth to my druggist, and the remainder I fed out to my hens, and, as a writer of old has said, I found nothing so good and nourishing for laying hens as sunflower seeds. Then I cut off the empty heads, place them near the bee-hives, fill them with sugar

and water, and that suits the bees to a T. So you see I was at no expense, and they paid well. I write this that others may be benefited as well as myself.
DR. R. HITCHCOCK.
South Norwalk, Conn., Feb. 2, 1875.

SWARMING. All animated nature seems to have some means of reproducing its like, that the species may not become extinct; and, especially among the insect tribes, we find a great diversity of ways and means for accomplishing this object. In the microscopic world we find simple forms of animal life contracting themselves in the middle until they break in two, and then each separate part, after a time, breaks in two, and so on. With bees we have a somewhat similar phenomenon. When a colony gets excessively strong, the inmates of the hive, by a sort of preconcerted, mutual agreement, divide themselves off into two parties, one party remaining in the old hive, and the other starting out to seek their fortunes elsewhere.[202]

I have carefully watched this proceeding, with a view of determining how the matter comes about, that is, whether it is because a part of the bees become dissatisfied with their old home, and seek to better their condition, or because the queen leaves, for some reason of her own (because she has not room to lay her eggs, for instance), and the bees simply follow from a sort of natural instinct, since she is the mother of the colony, and an absolute necessity to their prosperity. After seeing a number of swarms issue, and finding that the queen was among the last to leave the hive, I concluded that the bees take the lead, and that the queen simply followed as a matter of course, in the general melee.[583] Suppose, however, that the queen should not take a notion to join the new adventure. Swarms do sometimes start out with no queen accompanying them,[587] and they usually go back to the hive after a time, to try it again next day. If she does not go then, nor at the next attempt, they often wait until they can rear a new queen, and then go off with her. After I was pretty well satisfied that this is the correct idea of their plan, a little circumstance seemed to upset it all. A neighbor, wanting to make an observatory hive, drummed perhaps a quart of bees from one of his old hives. As he had no queen, I gave him a black queen taken from a hive purchased several miles away. I mention this to show that the queen had never been out of the hive, in the location which it then occupied. After a day or two, this neighbor informed me that I had played a fine trick on him, for my queen had gone home, and taken his quart of bees with her. I told him it was impossible, for she had never been out of the hive, only when I carried her over in the cage.

We went and looked in the hive she came from, and there she was, true enough, with the bees she had brought with her stung to death, in front and on the bottom-board. It is possible that the bees swarmed out first; but even if they did, they certainly followed the queen in going back to her old home. We also know that bees sometimes follow a young queen when she goes out to take her wedding-flight.

It is my opinion that it is neither the queen nor the workers alone that make the first start, but that all hands join together and act in concert.

WHY BEES SWARM.

If we attempt to contract the size of the hive when honey is coming in bountifully, the bees will be very apt to take measures toward swarming, about as soon as the combs are full of brood, eggs, pollen, and honey. They will often wait several days after the hive is seemingly full, and this course may not cause them to swarm at all, but it is very likely to. As soon as it has been decided that the hive is too small, and that there is no feasible place for storing an extra supply of honey where it can be procured in the winter, when needed, they generally commence queen-cells. Before doing this I have known them to go so far as to store their honey outside on the portico, or even underneath the hive, thus indicating most clearly their wants in the shape of extra space for their stores where they could protect them.

I believe want of room is the most general cause of swarming, although it is not the only cause; for bees often swarm incessantly when they have a hive only partly filled with comb. First swarms usually come about from the cause I have mentioned; but AFTER-SWARMING (which see) often gets to be a sort of mania with the bees, and they swarm, apparently, *without* a reason.

AT WHAT SEASON BEES USUALLY SWARM.

The old adage runs,—

"A swarm of bees in May
Is worth a load of hay;
A swarm of bees in June
Is worth a silver spoon;
A swarm of bees in July
Is not worth a fly."

There is much truth in this, especially if managed on the old plan; but with modern

improvements, a swarm in July may be worth a silver spoon, or even a load of hay; possibly, both together. See AFTER-SWARMING. A colony that was very populous in the fall, and has wintered finely, may cast the first swarm in May, in this latitude; but such events were very unusual before the advent of Italians. The latter often swarm during fruit-bloom, and in some cases even earlier. In our locality, swarms do not usually issue until the middle or last of June. If the season is a little late, sometimes the greater part of them will come in July, and we almost always have more or less swarming going on during our national holiday. At this time, basswood is generally at its height, and we frequently have quite a yield from clover, after basswood is gone. On this account, swarms that come out during the first week in July usually get enough to winter, and are therefore worth the price of a swarm of bees any way. I presume the old adage referred, principally, to the amount of honey they would store; if the July swarms did not secure enough to winter over, and were allowed to starve, they would not be worth the trouble of hiving them, and so they might be rated as of less value than a fly.[205] Swarms that come out in June would fill their hives, and perhaps make a surplus that, on an average, would bring at least a dollar, the old price of a silver spoon; while those that were so thrifty as to be able to start in May would have the whole season before them; and if they did not get set back before white clover came out, would very likely make a surplus worth $5.00, the market price of a load of hay. In some localities bees seem to swarm in the latter part of July and August, and reports seem to show that they do it when little or no honey is to be had, and when the bees are disposed to rob; but such is certainly not the case here, for our bees give up all preparations for swarming, some little time before the honey-crop has ceased. I do not remember ever to have seen a natural swarm issue here later than July; but in some localities, buckwheat swarms are a very common thing. Where the apiarist has plenty of extra combs filled with stores, it is an easy matter to care for and make valuable stocks of swarms that issue at any time.

"HOW DO YOU LIKE MY CATCH?"

SYMPTOMS OF SWARMING.

Although we can sometimes tell when bees are going to swarm, I do not think it will be safe, by any means, to assume we can always do so. It has been said, that the bees which have been clustering outside will, all the morning of the day they are intending to swarm, go inside the hive; but this can not always be so, for I have seen a swarm issue while the loafers were hanging on the outside as usual; and at the sound of the swarming-note, they took wing and joined in. Where a colony is intending to swarm, they will not be working like the rest, as a

general thing; and quite likely, on the day they are intending to swarm, very few bees, comparatively, will be seen going out and in at the hive.[206] With movable combs we can generally give a very good guess of the disposition to swarm, by opening the hive. Bees do not, as a rule, swarm until they have got their hive pretty well filled up, and have multitudes of young bees hatching out daily. The presence of queen-cells is generally considered an indication of the swarming fever.

"THOSE PETS."

Many think that the clustering of the bees on the outside of the hives is an indication that they are going to swarm. To a certain extent this may be the case, but it is by no means an indication that they are going to swarm very soon. I knew a colony, belonging to a neighbor, that hung out in great masses nearly a month before the bees came out. His new hive was in readiness, and he stayed at home and watched day after day, until clover and basswood both were almost gone, and finally they cast a truly large, fine swarm.

NEVER ALLOW BEES TO HANG OUTSIDE THE HIVE.

This swarm had hung outside the hive during the great honey-harvest of the season; and as it is no unusual thing for a colony to store 10 lbs. a day, during the height of the season, they may have lost 100 lbs. of honey, for the swarm was an unusually strong and fine one. I think they could easily have secured this amount if they had worked, but it is by no means certain that they could have been made to go to work as they did after they swarmed and were put into a new hive. Within two or three weeks after they swarmed, if I remember, they filled their hive, and gave about 25 lbs. of surplus. How shall we deal with such bees?

This clustering-out may be caused by the fact that the bees need room. In that case, obviously, an extracting or comb-honey super should be placed on top; for if the bees get into the habit of loafing it may be a little hard to get them to go up into the supers In such case I would advise giving the bees a section or two of honey partly drawn out, as previously explained under COMB HONEY. I would at the same time also enlarge the entrance. If you do not use a Danzenbaker bottom-board, as described under ENTRANCES, set the hive up on four blocks ½ inch thick. This will leave an open space all around the hive, but that will do no harm. If the primary cause of the bees clustering out in the first place is lack of ventilation, or too great heat, this raising-up of the hive will cause the bees to go in, and possibly prevent swarming. See ENTRANCES; also COMB HONEY.

PREPARATIONS FOR SWARMING, TO BE MADE BY THE BEE-KEEPER.

Every apiarist, even if he have but a couple of hives, should make preparations for swarming, at least to some extent; for, even though dividing (see NUCLEUS) is practiced, and the utmost care used to prevent any other, there will always be a chance that swarms may come out unexpectedly. First of all, and before the swarming season, the wings of all queens should be clipped, and hives should be in readiness. Extra combs should be placed in the honey-house where you can put your hand on them at any minute. I would also have some hives where I could get a comb of unsealed larvæ, without very much trouble; that is, make up your mind what hive you are to go to, in case you should want such a comb in a hurry. Bees will often swarm on Sunday; and as we would not wish to work with our bees on the Sabbath more than is absolutely necessary, it behooves us to be at all times prepared to take care of a swarm, should it come, with very little trouble. I can remember having swarms on Sunday, when it became necessary to hunt up a hive, decide on its location, hunt up some empty combs, and then look over my hives to see where there was one with no surplus boxes on, that I might get at a brood-comb with as little trouble as possible, to put in the new hive, to prevent them from decamping. All these

things take time, and more than one swarm have departed while a hive was being made ready to receive them. If you keep the wings of your queens clipped as I have advised, you will need some queen-cages where you can lay your hands on them at a minute's notice, for there are times when you need to step about as lively as you would if a house were on fire, and you do not want to be bothered by hunting for things.

MILLER QUEEN-CATCHER.

The best queen-catcher, or, rather, a cage for confining the queen, during the swarming season, is the Miller introducing-cage, a cut of which will be found under INTRODUCING. We will suppose that a swarm has just issued, and that your clipped queen is hopping around the entrance of your hive. Your wife or attendant, feeling some hesitancy about picking up so delicate an object by her silken wings, can take a cage of this kind and place the mouth directly over her. In a moment, finding herself confined, she will ascend into the cage. The little wooden plug is now inserted, and your captive queen can be placed among the flying bees, and the swarm hived as described next. The cage is also used for introducing. See INTRODUCING.

HOW TO HIVE A SWARM WITH CLIPPED QUEEN; THE PLAN WE PREFER.

Under the general head of QUEENS, subhead CLIPPING, I have already given intimation how swarming may be controlled to a certain extent by clipping. The practice has come to be almost universal among practical honey-producers at the present time, for where queens' wings are clipped, or they are prevented from leaving the hive by the use of Alley traps or entrance-guards (see DRONES), a great amount of labor may be saved.

We will assume that all queens in the apiary have their wings clipped. A swarm comes forth. Go to the hive from which it is issuing; and, while they are coming out, cage the queen, which will be found, in all probability, hopping around in the grass near the entrance, vainly endeavoring to fly with the rest of the bees. Cage her, and then slip the cage into a pocket or some cool place, temporarily. Remove the super or supers into which the bees have already started to work, and set them on the ground near the hive. The brood-chamber should now be removed just as it is, to an entirely new location. Put in its place on the old stand a hive containing frames of foundation or empty comb, and on top of this a queen-excluding honey-board. Some prefer having only starters of foundation. Next put the supers, placed on the ground temporarily, on the new hive containing the frames of foundation or comb. Now lay the caged queen in front of the entrance.

All of this may be done while the bees are in the air, and it will not be long before they discover that the queen is not with them, and return pellmell to their old location, and rush into the new hive. After they are well started to going in, the queen may be released, when she will go with them.

The work already begun in the supers will be pushed on and completed with more vim and energy than before, because a new swarm always works with new energy. If only frames containing starters are given them, what honey does come in is forced right into the supers, for the bees have absolutely no place to store it, or at least not until foundation below has been drawn out; and as soon as this takes place it is occupied immediately by the queen.

The old hive containing frames of brood and queen-cells now in another location may cast forth a second or a third swarm; but if queen-cells are cut out, even second swarming may, to a very great extent, be checked.

This method of handling swarms commends itself especially to the women-folks, who are generally at home. All they have to do is to hunt up the clipped queen, cage her, and then put an empty hive containing frames of foundation in place of the old one. As it might not be practical for the women to carry the old hive to another location, they can simply drag it over to one side, and change the entrance so that it will face to the rear. When the "man of the house" returns, he can lift the supers off from the old stand on to the new one, then take the old brood-nest over to another location. This can be done any time within a day; or, when preferred, the old stand can be left alongside of the new one, providing the entrance is reversed.

If two or more swarms come out at the same time, and one of them has a virgin queen, all the bees will be likely to unite with the one having the queen; then, of course, this plan of bees returning will come to naught. But in a well-regulated apiary there will be few such occurrences as this, and ninety-nine out of a hundred swarms may be hived as easily as this, without any trouble.

SWARMING-DEVICES, VARIOUSLY CONSTRUCTED.

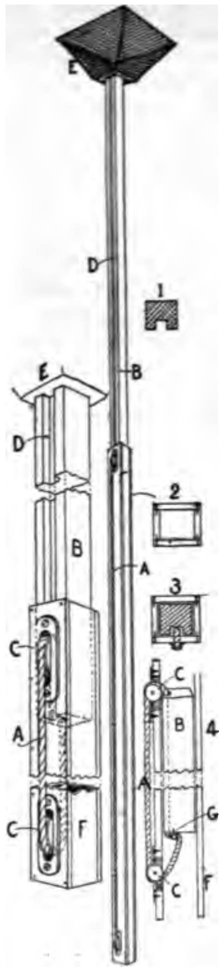
Every apiarist engaged in the production of honey should by all means have the wings of *all* his queens clipped. He *can not afford not to*, unless he uses perforated zinc (see DRONES). It is much more difficult to take care of swarms when queens are allowed to go with the swarm. But as there are some who dislike to "disfigure" or "mutilate" their queens: and as some swarms in any case will get out with a virgin queen. I have thought best to describe the various devices for capturing swarms with unclipped queens. See QUEENS, subhead CLIPPING.

Almost every apiarist has his own peculiar notion as to how a swarming-device should be constructed. Some of these implements are very ingenious, and valuable assistants during the swarming season. Their particular use is to remove a swarm after it has clustered, and place it in the hive where it is desired that the new swarm shall take up its new abode. The first one to which I call attention, not because it is the best, but because it is the simplest, is a sort of butterfly-catcher.

The hoop is made of stout wire, and is about 20 inches in diameter. The ends are soldered into a tin socket that will receive a rake-handle, or, for tall trees, something still longer. The bag is to be put up under the swarm, and the hoop is then made to gently cut off the cluster so that the bees will fall into the bag. It is then turned edgewise, so as to confine them while it is taken down and carried to the hive. As the bag is made of cheese-cloth, they have plenty of air. To get the bees out, turn it inside out. The bag has the same diameter as the hoop, and is about four feet long.

THE MORTON HIVING-POLE.

The late Miles Morton, the one who used fences in the production of comb honey for many years, and concerning whom reference is made in COMB HONEY, devised a sort of extension pole that will prove very useful in capturing swarms that alight on high trees. **The basket is very similar to the Manum; that is, it is a wire-cloth cage in the shape of an inverted pyramid pivoted at its two opposite corners, and supported by means of a Y. The illustration does not show the basket attached as it should be, although the half tone engraving shows it correctly.**



The machine consists of an outer hollow pole and an inner one, both square. The outer pole is virtually a long box about 2 in. square on the outside, and 12 feet long. A cross-section is shown at 2 in the cut. Inside this hollow square pole another square pole is made of about the same length, and just large enough to slide up and down easily. A longitudinal groove, about ⅜ inch wide and deep, running its entire length, is cut on one side, as shown at D, D. This groove is to receive the rope C C. At each end of the outer pole are let in two ordinary sash-pulleys, as at F, and an ordinary clothesline is then passed through the pulleys. The grooved inner pole is then slid into the outer one, so that the rope lies in the groove. The two ends of the rope are then fastened *at one end*, and "this is where the fun comes in," said Morton; "for it is quite a trick to get the two ends of the rope fastened, and yet have the rope taut after the job is done." The thing to be accomplished is this: The two ends of the rope are made to abut together in the groove four or five inches from the bottom end. They are then stapled down securely. The rope may then be stapled down as at G, in the drawing; but Mr Morton had the two ends of the rope abutting together in the groove. Now, be sure and not make the mistake of fastening the rope at *each end* of the grooved pole, for that will never do, because

that will render it impossible to draw the inner pole out of the larger one, as you will see by a moment's reflection; and if you will reflect a little more you will see that it is not an easy matter to fasten the ropes at

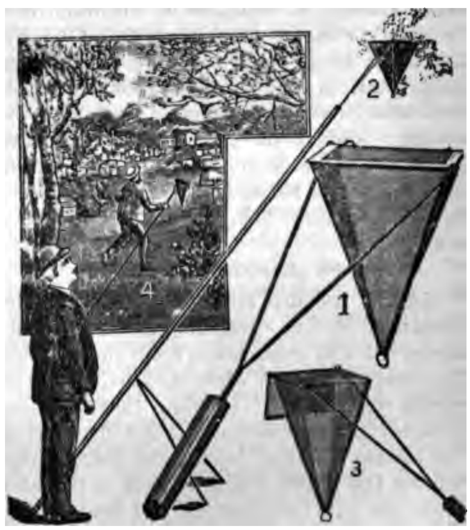
one end so they will be taut. Although there are two or three ways, Morton's method was to cut off the strip that holds the lower sash-pulley, at a point about five or six inches from the end. This piece, with the pulley, can be pulled out of position temporarily. It is now possible to bring the two ends of the rope together, because we now have a little slack. After they are fastened end to end, the piece with the pulley is sprung back into place and fastened with screws.* If every thing has been done right this will take up the slack of the rope, and make it taut.

The operation of the machine will be apparent from the illustrations. By pulling on the rope, the pole may be extended to nearly double its length; and when it is stretched out to its fullest extent it may be made to reach a swarm 30 or 35 feet from the ground. If the swarm happens to cluster on a limb higher than this, it will then be necessary for the apiarist to get up into the body of the tree where he can, with this swarmer, reach the bees, jar them into the basket, and then let the pole down to an attendant.

A. E. MANUM'S SWARMING-DEVICE.

This consists of a wire-cloth basket made in the shape of an inverted pyramid, and pivoted at the two opposite corners so as to hang always in an upright position. When a swarm is captured the basket may be grasped by the ring in the smallest end, and inverted, dumping the bees into the hive prepared for them.

Fig. 1 represents the wire-cloth cage or basket; Fig. 2, the device in position, receiving the bees as they cluster on the outside of the cage. Fig. 3 shows the cage open. As soon as the cluster beginning to form is half or wholly completed, run the basket up to and around the cone of bees. An assistant, if present, gives the limb a jar, so as to disengage the bees into the basket. In case no one is ready to assist, a sliding movement will precipitate the cluster into the wire-cloth cage, when it is quickly lowered. This operation, in passing down through the limbs, will usually catch the wire-cloth lid, and close it with a slam. In case it is not closed, the apiarist steps forward and does it himself. Half or two-thirds of the bees are generally confined. In all probability the queen is there also. As the bees can not get out, those still flying in the air will very readily cluster on the wire cloth, surrounding the majority of their companions inside. To make this more expeditious, the tripod is adjusted, and the cage is suspended in the air, as shown in Fig. 3, right where the bees are flying thickest. In two or three min-



MANUM'S SWARM-CATCHING DEVICE.

utes the remainder of the bees will be clustered on the outside. At this stage of the proceeding the apiarist comes forward, folds the two short legs against the pole, grasps it at its center of gravity (see Fig. 1), and walks

* Use screws so that the piece may be removed for the future, to take up slack when necessary.

off to the hive, which he has previously prepared. The wire fork is made of steel, and is light and springy. The walking of the apiarist has no tendency then to jar the bees off from the basket.

One of the special features of the Manum arrangement is, that the basket can be adjusted to almost any position, all the way from 2 to 10 feet from the ground. All that is necessary is to spread the tripod legs, catch them into the ground, and leave them standing. In the mean time, if the hive is not prepared, the apiarist has ample time to get it ready. After this he can return to the swarm just now clustered. Most of the devices require to be held until the cluster has settled. It is a tedious job to hold a pole at arms' length, with face upturned. If the swarm clusters very high, some other arrangement, perhaps, would be better than the Manum; but for low shrubbery it is just the thing. The other special feature of the device is, that, after you have gotten about half or two-thirds of the bees into the basket, they can not escape and seek their original point of attachment.

THE SWARM-HIVING HOOK.

With most of the hiving-devices I have illustrated, what might be called a hiving-hook can be used to considerable advantage at times. It is simply an iron hook, large enough to compass an ordinary limb on which swarms cluster, mounted on the end of a long pole, therefore resembling, somewhat, a shepherd's crook. One of the hivng-devices is passed beneath the swarm. This hook can reach over, grasp the limb on which the swarm is clustered, and one or two smart jerks will jar the bees into the basket, bag, or box, as the case may be.

SWARMING-LADDER.

Swarms usually alight low, so that the ordinary hiving - implements previously described will reach them from the ground. But there are times when they will settle on pretty high limbs. It is then that a ladder is called into requisition. If it will not reach the swarm it will at least land the climber among the upper limbs, so that he can step from one limb to the other, and finally reach the bees. But it is difficult to stand an ordinary ladder against a limb of a tree so that it will be secure for climbing, on account of the unevenness of the limbs. A Bohemian by the name of R. Strimpl, of Seltzschau, Bohemia, sent us a drawing of a ladder that can be lodged—that is, the upper part of it—securely on some limb above. The engraving illustrates its principle of application.

The two side arms, or forks, prevent the ladder from revolving; and it will be observed that the ladder terminates in a single pole, which can be very easily lodged in the fork of a limb, where a two-pronged ladder

STRIMPL'S SWARMING-LADDER.

would not. The three prongs below the ladder are sharpened at the ends, and securely pushed into the ground; and the perfect lodgment of the other end in the crotch of the limb makes the ladder a safe means of ascent. Aside from this, the ladder will be lighter. But it is desirable to prevent swarms from going beyond our reach—at least clustering on elevated limbs. The following is one of the indispensables, especially if the queen's wings are not clipped.

SPRAY-PUMP, FOR CONTROLLING SWARMS WHILE IN THE AIR.

One of the most useful implements for the apiary, during the swarming-time, is a good hand force-pump. A swarm of bees in the air with a queen, that might otherwise circle about for fifteen or twenty minutes, may usually be made to cluster in from two to five minutes by its use. Whether the fine particles of water dampen the wings, and so impede their flight, or cause the bees to think it is raining, and that therefore they had better cluster at once, or both, I will not say; but certain it is, the spray has a very decided effect. One who has become moderately expert will be able, not only to make the bees settle, but to *compel* them to clus-

ter on some point easily accessible to any of the ordinary hiving-devices just described. Occasionally a swarm will make for the top of a tall tree. With the pump we head them off, and cause them to settle on a lower branch. Even when a swarm is clustered twenty or thirty feet from the ground, by adjusting the stream nozzle, and letting it play directly on the swarm itself, we can, many times, dislodge them, cause them to take wing, and finally to settle again upon a lower point of attachment. Again, several swarms will come out simultaneously, two or more of which will be likely to cluster. By the timely use of the spray, each swarm can be kept separate by keeping the wings of the stragglers of the two swarms about to come together dampened. A good many times, a swarm that is about to abscond can be headed off and made to cluster; in fact, our boys, during the summer of 1889, could drive a swarm about like a flock of sheep. It is very annoying and inconvenient to have a swarm pass from our premises over to those of a neighbor. During the summer of 1889 we had something like eight or ten swarms come out every day, for about one week, and yet in only one or two cases did they leave the immediate vicinity of the apiary; and had it not been for the pump, we should, in all probability, have had to chase all over the neighborhood, to say nothing about climbing tall trees.*

After a swarm begins to cluster on a desirable point, stop spraying in this direction. Retreat, and drive the stragglers toward it, but be careful not to spray the place where they are clustering. As a general rule, there will be two or three small clusters forming at once. Spray the undesirable ones, and keep them sprayed until these points of attachment are abandoned.

During the swarming-season it is a good idea to keep several barrels of water in and around the immediate vicinity of the apiary, so as to have the water right handy. If you run to the pump every time you use a pail of water, a swarm may get away from you, or cluster in the top of a tall tree.

SWARM-CATCHER.

This is simply a large wire-cloth cage, in the shape of an oblong box, say about 3 or 4 feet long, by about 12 or 15 inches square. One end of this cage is open, and is made so as to fit against an ordinary hive-front.

It very often happens that the apiarist is on hand just at the time when the swarm is pouring out from the entrance like hot shot. Well, if he has one of these swarm-catchers handy he simply attaches the mouth to the entrance, and the outpouring bees go pell-mell into the top of the cage, and are there confined. If the apiarist succeeds in getting two thirds of the bees, the rest will cluster on the outside. The cage is set very near where the bees come forth, the mouth end down. In the mean time he prepares his hive, if he has not already done so, and then brings the cage of bees and dumps them right into the hive, replaces the cover, and the swarm is hived, without having any swarm in the air—no, not even giving them a ghost of a chance to fly all over the neighborhood, and possibly finally alight upon the limb of a tree 40 feet from the ground. But it should be borne in mind that the swarm-catcher is serviceable only when the apiarist happens to be on the ground, just as the bees are beginning to pour forth.

HOW TO HIVE SWARMS WITHOUT SPECIAL HIVING-DEVICES.

If the apiary be located in a locality where there are no tall trees, with only low-growing shrubbery, or, at most, low-growing fruit-trees, or, better still, the wings of all queens clipped, the special tools I have already described will not be found absolutely necessary, and perhaps not even a convenience, if we except Manum's arrangement. Our own apiary, illustrated in connection with some of the factory engravings shown in the introductory, you will notice has no trees in the apiary. Outskirting it are rows of bushy evergreens. There is absolutely no place for the bees to cluster in the immediate vicinity of the apiary, except on one of these evergreens, or else on one of the grapevines in the apiary itself. Rarely do we have swarms cluster elsewhere. If one alights on one of the two places just mentioned we select a frame of unsealed larvæ, the use of which has been previously anticipated. As the swarm is rarely ever above four or five feet from the ground, this frame is gently thrust among the bees. A large majority of them will very soon lodge upon the frame. This together with the adhering bees is placed in a hive on the shady side of the evergreen or grapevine, in company with three or four more frames. Those bees which have already clustered on the frames will begin to call their companions. As soon as a few bees have discovered the entrance, a few will indicate their discovery

* We didn't then clip the wings of our queens as we now do. All that chasing is now dispensed with.

by the usual humming of the wings. An enamel sheet can be placed over the cluster. A bunch of grass will now brush the bees out of the way so the cover can be shut down without smashing any bees. The hive is left until the bees have all entered it. Before they have had time to fix a location, they are removed to their permanent location in the apiary.

HIVING A SWARM UNDER DIFFICULTIES.

From British Bee Journal.

You will scarcely appreciate the absence of large trees and the presence of small undergrowth, until you have had an apiary so circumstanced. Swarming does not have half the terrors to the bee-keeper that it does when the clusters are just as likely as not to attach themselves to elevated positions.

The methods I have just described applies when the queen's wings are not clipped, either because we do not wish to mutilate her fair proportions or because she happens to be a young queen. But a great many times apiarists prefer to clip their queens' wings. Perhaps I might say a majority do so, because it saves the use of any expensive tools, tree-climbing, and, to a great extent, swarms uniting.

TWO OR MORE SWARMS COMING OUT AND UNITING.

When the swarming-note is heard in the apiary, it seems to carry with it an infection; this may be a mistake, but in no other way can I account for swarms issuing one after another, while the first is in the air, unless they hear the sound, and haste to go and do likewise.[210] Of course, they will all unite in one, and as many as a dozen have been known to come out in this way, and go off to the woods in a great army of bees, before any thing could be done to stop them. If your queens are clipped, and you "hustle around," and get them all in cages deposited in front of the hives, they usually separate and each bee go where it belongs.[591, 211] Unless you have plenty of help, you will be unable to get the hives all moved away, and a new hive fixed for each one before they come back. In this case they will go back into their old hive, and, if the queen is released, will sometimes go to work; but oftener they will swarm out again within a few hours, or the next day; and if you keep putting them back they will soon attack and kill their queen, and loaf about until they can rear a new one, and then swarm.[212] This is very poor policy, and we can by no means afford to have such work. If they swarmed for want of room, they may go to work all right, after having room given them.[595] If they come out the second time, I should give them a new location, divide them, or do something to satisfy their natural craving for starting a new colony, otherwise they may loaf, even if they do not try to swarm again.

To go back: Suppose they get a queen or queens having wings, and cluster in one large body. In this case you are to scoop off bees from the cluster, with the swarming-bag, a tin pan, or a dipper, as may be most convenient, and apportion parts, made about as nearly of the size of a swarm as may be, about in different hives. Give each hive a comb containing eggs and larvæ as before, and then get a queen for each one if you can. In dividing them up, should you get two or more queens in a hive, they will be balled as I have before described, and you can thus easily find them. If more than one queen is in a hive, you will find a ball of bees, perhaps the size of a walnut or hen's egg, about them, and this can be carried to the colony having none. If you can not tell at once which are queenless, you will be able to do so in a few hours by the queen-cells they have started. If you are more anxious

for honey than bees, you may allow two swarms to work together; and if you give them sufficient room, you will probably get a large crop of honey from them; but this plan does not pay, as a general thing, because the extra bees will soon die off by old age, and your colony will be no larger than if the queen had had only her ordinary number of bees.

PREVENTION OF SWARMING.

If we can entirely prevent swarming, and keep all the bees at home storing honey all the season, we shall get enormous crops from a single hive. Whether we shall get more in that way than from the old stock and all the increase, where swarming and after-swarming is allowed, is a matter as yet hardly decided. If a swarm should come out in May, and the young queens get to laying in their hives by the first of June, their workers would be ready for the basswood - bloom in July, and it is very likely that the workers from 3 queens or more would gather more honey than those from the old queen alone. But, another point is to be considered. The two or three new colonies must have stores for winter: and as it takes nearly 25 lbs. to carry a colony through until honey comes again, this amount would be saved by the prevention of swarming. Where one has plenty of bees, and desires honey rather than increase, a non-swarming apiary would be quite desirable.

This subject is a mooted one, and some of our best and most experienced bee-keepers —Dr. Miller among the number—confess they have been baffled in their efforts to confine swarming within reasonable limits. Usually it is not desirable to prevent first swarms. Second swarms or after-swarms are the ones we should *like* to control. Some prominent bee-keepers practice cutting out all queen-cells but one, eight days after the issue of the first swarm; that is, they allow all the unsealed larvæ to become capped over, leaving no opportunity for further building of cells. If only one cell is left in the hive, of course only one queen can be hatched and reared. If she is successfully fertilized the colony will generally settle down to business. Excessive swarming is often brought about because a number of young queens are allowed to mature about the same time. These unfertile queens will be pretty apt to keep up swarming in the hive so long as there is a surplus of queens. See AFTER-SWARMS.

PREVENTION OF SWARMING BY CAGING OR REMOVAL OF QUEEN.

Hetherington, Elwood, and some others, have practiced caging or removing the queen during the honey harvest. Of course, no swarm will issue regularly without a queen in the hive; and if no cells are allowed to hatch, the prevention is accomplished. When the harvest has commenced, before giving the bees a chance to swarm, the queen is caged in the hive, or, perhaps, preferably given to a nucleus. If queen-cells are not already started they certainly will be on removal of the queen; and if the queen is caged they will just as certainly be started in a short time. In any case they must be cut out before any possible danger of the queen's hatching. If all cells are destroyed at the time of removing the queen, then a second time, eight days later, and a third time eight days later still, there will be no possibility of any swarming. The advocates of this plan claim that the bees that would be raised from eggs laid at the time during which the queen is caged or removed would be too late to be of any service in gathering the harvest, hence only consumers.

On the other hand, there are those who question whether the bees work just as industriously without a laying queen in the hive. One difficulty about the plan is, that it is about impossible to be sure that no queen-cell has been missed; and a missed queen cell gives rise to very undesirable complications.

Many times bees will swarm because the apartment for brood-rearing is limited. Contraction and the queen-excluding honey-board give the queen only a limited amount of room, and swarming is the consequence. For this reason it is desirable not to reduce the brood-chamber too much. But whether contraction is practiced or not, the fever may be greatly allayed, and perhaps prevented altogether, by giving an abundance of surplus room on the plan of tiering up. Do not let the colony at any time feel crowded for space. Judicious tiering up, as described under COMB HONEY, will not only secure more honey, but it will largely discourage natural increase when not desired. When running for extracted honey, the problem is much easier. Mr. E. France, of Platteville, Wis., who produces enormous crops of honey, says he is very little troubled by excessive swarming. He does not practice contraction, but allows the queen and bees plenty of room. If the queen desires to go

above, she is allowed that privilege. Charles Dadant & Son keep about 500 colonies in large Quinby hives. These hives are so large that the bees are but little inclined to swarm. In fact, Mr. Dadant says, in the *American Bee Journal*, page 311, Vol. XXV., "For more than fifteen years we have dispensed with watching the bees of our home apiary, numbering from 80 to 100 colonies. As the yearly number of natural swarms does not exceed two or three, the expense of such watching would be far above the profit." While large hives filled with combs or foundation tend to prevent if not discourage swarming altogether, for other reasons other bee-keepers seem to prefer smaller sizes, such as the Langstroth. See Dadant hive, under HIVES.

THE PREVENTION OF SWARMING WHEN RUNNING FOR COMB HONEY BY SHAKE-OUT OR BRUSHED-SWARM PLAN.

The control of swarming when operating for extracted honey, especially if large hives are used (or small hives with one or more stories), is comparatively simple; but when one proposes to run for *comb* honey, and feels compelled to use small brood-chambers because of the shortness of the season in this locality, the problem has not been so easy of solution. But in Germany, and lately in America, a plan has come in vogue that looks now as if it *might* give us a control. At all events, those who have tried it are very enthusiastic in its praise, and feel that for them, at least, the vexed question has been settled for all time. The plan is, in brief, this:

Just at the beginning of the honey-flow, and perhaps three or four days before the colony is expected to cast a swarm, the hive is moved to one side of the stand, and an empty one, just like it, is put in its place. In this hive are placed frames having foundation starters or frames with full sheets, but preferably the former. But if neither is available, empty combs may be used. The bees of the parent colony are then shaken or brushed in front of the entrance of the *new* hive on the *old* stand. Some go so far as to brush *all* the bees out of the old hive; and this can be done if the weather is hot and the nights warm; for young hatching brood will soon be out to take care of the young brood. The supers on the parent hive are next put on the new hive. The parent colony is then moved, either to a new location or it may be left by the side of the new hive with its entrance facing in the same direction. In either case the entrance should be contracted.

The shaking or brushing of bees in front of the new entrance, causing them to run in, apparently gives them the impression that they have swarmed. If work is already partly begun in the super, the bees will begin to work, and rush the honey in above. In some cases it may be advisable to use perforated zinc between the super and broodnest to keep the queen below.

Those who have tried this plan say that colonies so treated are not liable to cast any swarm; in fact, it puts the swarming at just the time when the apiarist can take care of it to the best advantage, for on this plan he is supposed to treat every colony strong enough to cast a swarm in the manner before stated.

The plan will meet favor, especially with those in localities where the season is short and the honey-flow rapid; and it will doubtless enable many who get no comb honey at all to secure a good crop.

The question will be asked, "What is done with the parent hive with all its brood?" If it is left beside the new one, the brood, when it is hatched out, is shaken in front of the new hive, so that at the last drive all the bees that would have been hatched in the original colony are now given to the brushed swarm, after which the hive is moved away. In this respect a brushed or "shook" swarm, as some call it, will secure more comb honey than a natural swarm, because it has the additional strength of the young bees.

PREVENTION OF SWARMING BY THE USE OF THE EXTRACTOR.

Without doubt, the greatest reason for swarming is that the bees have got their hive full of honey, and there is no more room for them to labor to advantage; accordingly queen-cells are started, and other preparations made, and they get, as we say, the swarming fever. Now, if their honey is taken away, and more room given them before they have begun to feel cramped for room, they will seldom get this swarming fever.[216] This room may be given by taking out combs filled with sealed honey, and substituting empty combs or frames of fdn., or it may be done by extracting the honey. This latter plan, I believe, is most effectual, for almost every drop of the honey can be taken away by extracting. We extract from the brood-combs as well as from the rest, and this can be done without any injury to

the brood, if we are careful not to turn so fast as to throw out that which is unsealed. I would do this, however, only in extreme cases, where the bees will not work, and are determined to swarm. The honey around the brood is generally needed there, and would better not be removed. It should be remembered that this remedy to prevent swarming is not infallible, and I do not know that any one is, at all times. I have known a swarm to issue the day after extracting all the honey I could get from the hive, but they had probably got the swarming fever before any extracting was done. At another time, the bees swarmed while I was extracting their honey.

NON-SWARMING HIVES.

A few years ago it was quite common to talk of non-swarming hives, and there were many inventors who claimed to have accomplished the end desired. The most of these hives were covered by a patent, and they have gone the way of most, if not all, patented bee-hives. Giving the bees abundant room, both over the cluster and at its sides, will do very much toward making a non-swarming hive; but they will swarm occasionally, in spite of us. Keeping the hive well shaded, or having the walls entirely protected from the sun, will do much to discourage swarming. A good wide and deep entrance has also some effect. See ENTRANCES.

PERFORATED ZINC TO RESTRAIN QUEENS.

Under DRONES, an incident is given in regard to the matter of entrapping the queen when she issues with the swarm. The employment of perforated zinc will not prevent swarming, but it prevents the bees from accomplishing their purpose; that is, swarming out and taking their queen with them. In other words, the perforated zinc simply takes the place of clipping the queen's wings. In some cases it may be desirable to use the zinc instead of clipping. Usually, from what experience I have had, I should say it is preferable to clip the queen's wings rather than to cause the bees the inconvenience of crawling, during the continuance of the honey-flow, through narrow perforations of zinc, simply for the purpose of preventing the issue of the queen should the swarm come forth.

While I recommend clipping in place of using perforated zinc, yet in the case of very strong colonies in the height of the honey-flow, especially if such colonies are in two-story hives, it is more practical to put on entrance-guards or Alley traps. In the first place, the attaching of the traps can be done in a tenth of the time it takes to find the queen; and in the second place, pulling the hive all apart to find her majesty causes more or less interruption.

THE ALLEY TRAP IN HIVING SWARMS.

When a swarm issues (see cut under DRONES), the bees will pass the guard; but the queen, on finding herself shut in, will pass "up stairs" in the same way as the drones. Sometimes, however, instead of going above she will return into the hive. In five or ten minutes, the bees, on discovering the absence of their queen, will go back to the hive. The bees should not be allowed to make more than one attempt to swarm in this way, for failing in the attempt to swarm again with the queen they will be likely to kill her. The bees may, however, cluster without the queen.

If the queen enters the upper apartment, the entire trap can be detached, fastened to a rake or some other object, and placed among the flying bees. Of course, they will readily cluster about the cage, when they can be hived; but keeping an Alley trap attached to all hives that are likely to send out a swarm during the ensuing ten or twenty days would be rather expensive, both because of the cost of the trap itself, and because of the inconvenience to the laden workers coming home. The same or very nearly the same result can be attained by clipping the queen's wing, at no expense whatever; and at the same time the bees have, up to the time of swarming, a free and unobstructed entrance.

THE AUTOMATIC HIVING OF SWARMS.

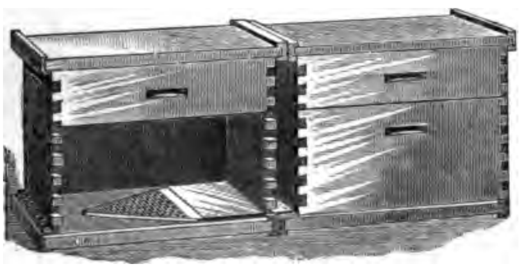
For many years back, there has been an effort on the part of bee-keepers of an inventive turn of mind to get up an arrangement that would automatically hive swarms

ALLEY AUTOMATIC HIVER.

in the absence of an apiarist or attendant; and since out-apiaries have begun to assume such importance where the production of honey is carried on extensively, some sort of device that will hive automat-

ically the swarms—yes, do the job just as well as if the apiarist were present himself—is a thing greatly to be desired. A great many devices have been introduced; but most of them have proved to be more or less of a failure.

The general plan contemplates some scheme whereby there may be an empty hive placed near the hive from which a swarm is expected to come forth. This empty hive may be alongside of, in front of, or below the other one. In the case of the first-mentioned plan, entrance-guards are placed in front of each hive; and connecting the two is a tube of wire cloth or perforated zinc. When the swarm comes forth, the queen finds herself barred by the perforated metal. She runs along until she finds the tube that communicates with the entrance-guard of the other hive. In this tube she runs up against a bee-escape or wire-cloth cone. She passes this; but, being unable to return, is compelled to enter the entrance-guard of the other hive. The bees, as soon as they discover the queen is not with them, rush back to the old stand; a part of them find the queen in front of the new hive; but a large part of them do not find her, and, of course, enter the old stand. Those with the queen will "set up housekeeping" in the new hive. But the plan fails, because the whole swarm is not captured in another hive.



PRATT'S SELF-HIVER.

Another plan provides for an empty hive in front of the one expected to cast the swarm, as shown in the accompanying illustration. A sheet of perforated zinc is formed into a bee-escape in the bottom of the empty hive; but the bees, until the swarm comes forth, are obliged to pass through this empty hive and through the zinc in going into their own regular quarters. Well, when the swarm does come forth, the queen follows along the perforated zinc until she reaches the opening in the end, or apex. She is thus caged automatically in an empty hive in which are placed frames of comb or foundation. The returning bees, coming back, find the queen in the empty hive in front. In some cases, at least, they "set up housekeeping" in the new hive, leaving the old one and a few young bees to take care of "the old home." It is expected, of course, as soon as the swarm is automatically hived, that the old hive shall be removed.

We have tried these plans to some extent, and the last one will work five times out of ten. But taking every thing into consideration, it is cheaper and more practicable to hive the swarm on the clipped-wing plan, or, better, practice the brushed-swarm plan, which I have previously described.

KEEPING BEES IN UPPER ROOMS AND GARRETS.

This plan for keeping a single colony, to furnish honey for the table simply, has been in vogue for perhaps centuries back. If the room is small, and made perfectly dark, the hive being placed back a few feet from the entrance in the wall, the bees will seldom swarm. One or more sides of the hive are generally removed, and the bees build their combs on the outside of the hive, or against the walls of the room, where the owner can go with knife, plate, and smoker, and cut out a piece for the table, without opening any hive, or disturbing anybody. In fact, he can consider this his "honey-room," and leave the honey stored there year after year, if he chooses. When a friend calls he can say, "Will you have a slice of new honey? or will you have one a year old? or two years old?" He might even have it ten or a dozen years old, for aught I know, if he has a taste for antiquated honey. Would not such a honey-room be nice? While writing about it, it has occurred to me that a room of this kind, fitted up with all modern appliances, might be a very pretty and a very useful thing. With the experience I have had in the house-apiary, however, I am inclined to think that, where there is so much room, there would be a great disposition in the bees to loaf and cluster on the sides of the room, in the shade, instead of going to work. Now for the objections.

If the hive and honey are close by the entrance, the bees will swarm as much as in the house-apiary. If it is a yard or more back from the wall, the bees, not being able to take wing in the dark, will crawl all this distance on foot, which would prove a great loss of time and strength, and, consequently, of honey. Providing the plan succeeds, you get a good crop of honey year after year, it is true; but you have all the time the efforts

of only a single queen. While your honey increases, your gathering force is no more, after the lapse of ten years, than it was before. If one colony is all you want, this may be all right. The queen can not live more than three or four years, and at her demise a new one must be reared and fertilized. For some reason, I know not what, she is very often lost in these garrets, and the colony dies of queenlessness. Worst of all, they will often swarm, and keep swarming, until nothing is left of them; but I believe swarming is rather the exception, and not the rule.

DO BEES CHOOSE A LOCATION BEFORE SWARMING?

We have ample proof that they sometimes do ; but whether such is always the case or not, we have no means of determining positively, so far as I can see. It is my opinion, that, although they usually do so, there are many exceptions. When a swarm of bees catches the fever by hearing the swarming-note of a neighboring colony, it seems difficult to understand that they could have selected their tree, and made the same provision for housekeeping that the first one may have done. The proof of this has been given many times through our journals. A neighbor of ours once saw bees going in and out of a tree, and, supposing that it of course contained a colony, went with his boys the next day and cut it down. It contained no sign of a bee. While they were standing still and wondering at this strange state of affairs, the boys, doubtless joking their father about his seeing bees where there were none, lo and behold! a swarm appeared in the air. They came to the very spot where the now prostrate tree had stood, and seemed as much astounded as a colony whose hive has been moved away. After some circling around they clustered in a neighboring tree, and were hived. They had selected this as their home, it seems, and an advance party had gone ahead the day before, to clean out and fix the hollow ready for the swarm, and it was these house-cleaners that my friend saw at work. I gave the above in *Gleanings* a few years ago, and a large number of corroborating instances were furnished by our readers. The number of bees that go out to look up a location is not usually great, but they may often be seen about swarming-time prowling about old hives, and hollows in trees, as if they were looking for something. After awhile, swarms come and take possession of these places, if they seem suitable, and of late a hope has been expressed, through the journals, that we might take advantage of this disposition, and fix hives so attractive that the bees will come out, select the "house and lot" that suits their taste best, and then, when they get ready, "move in." When this is accomplished we shall have automatic hiving.

DECOY HIVES.

Many of the friends have followed out the idea given above, by locating hives in the forests, in the trees, and such hives have in many cases been quickly accepted and appropriated. I believe we are indebted to Mr. J. H. Martin, now of Cuba, for first suggesting the idea. Hives left standing on the ground in the apiary have many times been selected by swarms, and, if I am correct, the bees, in such cases, often come out of the parent hive, and go directly to these hives without clustering at all.

One of our bee-keepers in California, by trading and otherwise, had something over a dozen empty hives. Having no immediate use for them he packed them up in a couple of tiers, about six high each. Each hive contained four or five combs, spaced so as to prevent the ravages of the moth-miller. One day, by accident he discovered some bees going into one of these empty hives. On examination he found that a swarm of bees had taken possession. His curiosity being now aroused, he examined some of the other empty hives. He kept on until he found six good swarms, each nicely housed, without any effort or expense on his part. In a few days more, the remaining hives were filled with absconding swarms. When the swarming season closed he had 17 colonies secured. The point is this: By accident he had stacked up his empty hives in tiers, so that they resembled trees in the forest. Having combs in them, and entrances open, they were an inviting place for a passing swarm. My brother, Mr. M. S. Root, of California, had a similar experience, and I believe that others elsewhere have become possessors of swarms in the same way. In view of this I would suggest having a few hives scattered, say, through an apple-orchard, in the shade of trees, each of these hives to be equipped with dry combs and a wide-open entrance ready for the reception of a possible swarm. Perhaps it might be advisable to have one or two hives perched in the limbs or the crotch of one of the large trees. If the combs are spaced two inches apart there will be no trouble from moth-millers, in case the hives should not be lucky enough to secure a swarm.

RINGING BELLS AND BEATING PANS TO BRING DOWN A SWARM OF BEES.

The books, of late years, have seemed to teach that this practice is but a relic of superstition, and that no real good was accomplished by the "tanging," as it is often called. Perhaps it usually has no effect in causing them to alight; but from watching the habits of swarms, I am inclined to think otherwise. Those in the habit of seeing queens on the wing are generally aware that the note they give when flying is quite different from that of a worker or drone; and many times, when a queen has escaped while being introduced, I have detected her whereabouts by the sound of her wings, before I had any glimpse of her at all. With a little practice we can distinguish this note amidst the buzzing of a thousand bees flying about, so as to turn our eyes upon her when she is quite a distance away. Is it not likely that the bees composing a swarm know this sound[599] as well as we do, or much better? Again, a swarm of bees usually has scouts to conduct them to the tree, or other place of their chosen abode, and it is quite likely they follow these scouts, and know of their presence as they do their queen, by the sound they emit from their wings. A noise, if loud enough, would be likely to drown these sounds, and thus produce disorganization. Throwing dirt or gravel among them will bring them down generally quite speedily, and I suppose it is because it produces disorganization much in the same way.

SYRIANS. See HOLY-LAND BEES, under ITALIANS.

T.

TONGUE OF A WORKER BEE. Of all delicately constructed pieces of organism, the tongue of a bee is one of the most elaborate and complicated in its general plan and arrangement of any thing that we find in all animated creation. Wonderful as is the sting, complex as are the compound eyes, and beautiful as are the silken wings, the little apparatus with which the bee takes up its food excels them all. Probably not one bee-keeper in ten thousand ever thinks of the tongue of a worker as being any thing more than one little flexible tube through which it sucks the nectar from the flowers; and it is but natural that one should so conclude after he watches one of his little pets with a glass, as it draws up the liquid sweet with that beautiful little tawny proboscis. But, strangely enough, it is not a tube, strictly speaking, but a combination of four *false* tubes formed by the overlapping and folding of parts. The whole little organism, delicate and minute as it is, consists properly of one tongue inside of another, and both parts —the inner and outer—are so constructed that one large tube can be formed around the smaller one. In Fig. 1 we have the tongue as it has been dissected from the head of the bee. The two large branches on the side, c c, are called maxillæ; the two smaller ones inside, labial palpi. These four close together, the former set above the lower, forming a tube through which the tongue proper, *a*, can work back and forth. See sectional views Fig. 2, at C, D, and. E respectively. The tongue, or ligula proper, *a*, Fig. 1, has a very minute groove running its entire length on the front, or on the top side as we look at it. On either side of this minute groove there is a sort of bend, or fold, which makes two more side ducts (see G, Fig. 2). Where a minute quantity of nectar is to be gathered, the central groove in the tongue will probably take care of the entire amount. If there is a larger amount, sufficient to fill the two side ducts as well as the central groove, they will all be brought into play. In such case, the tongue, as it sticks out of its sheath, so to speak, will be seen bent backward, sweeping sidewise over the surface that contains the liquid sweetness. When the bee desires to gulp down a large quantity of liquid at a time it makes use of the larger tube formed by the maxillæ and labial palpi both together. The question might be raised, "Why did the all-wise Creator make a proboscis for the bee so complicated as this? Why would not a single tube have been sufficient?" The tongue of a bee, elaborate as it is, and as large as it

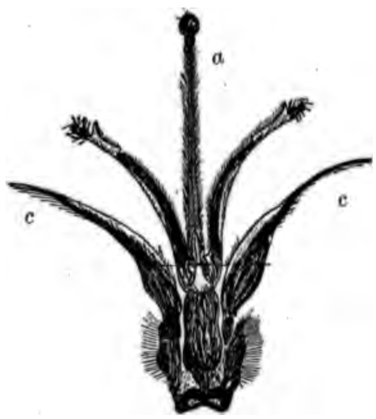


FIG. 1.—TONGUE OF A BEE, GREATLY ENLARGED.

seems to be in the picture presented, is in reality so small as scarcely to be seen by the naked eye. If there were a tube running the entire length through the tongue it would necessarily be so minute it would fill up, as Cheshire points out, leaving the dry honey or particles of pollen. Then if a bee had to depend on the small opening in the tube it would take it a long time to store its honey-sac full of nectar or honey if a large quantity of either were available. So Dame Nature steps in and provides four pseudo or false tubes—one large and three much small-

er ones—the last set inside of the other, either of which may be separated apart and opened out so that the inside of the tubes can be thoroughly cleaned; and then when cleaned the parts are put together in the twinkling of an eye, and the process of sucking up the sweet juices continues.

which large quantities, when available, are taken. At *c d* in G is shown the groove I have already referred to, and through which minute quantities are drawn. At *s d* in G is shown one of the side ducts through which a still larger amount may be drawn. All three of these close by folding, forming

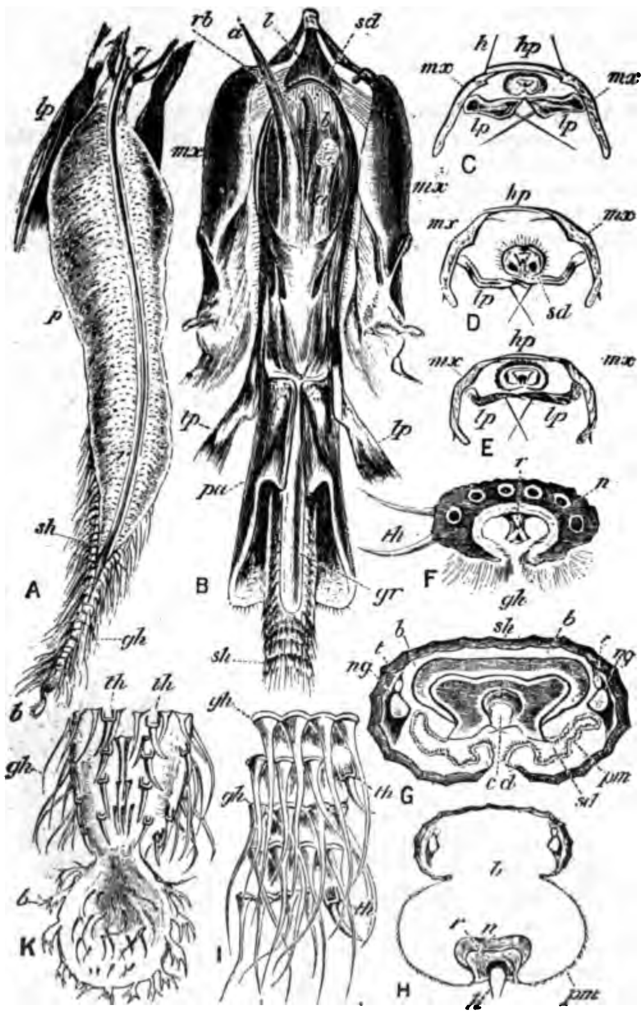


FIG. 2.—SECTIONAL VIEW OF THE TONGUE OF A BEE.—AFTER CHESHIRE.

In Fig. 2, taken from Cheshire, are shown sectional views as well as longitudinal views of the tongue as a whole. In C, D, E, respectively we have cross sections showing the outer and inner sets of tubes; *mx*, the maxillæ in connection with *lp*, the labial palpi, are folded together in the manner shown, forming the large tube, through which large quantities, when available, are taken. At B we have a portion of the tongue proper, showing how it is attached to the mentum. At A we have the same view, but the tongue is distended, according to Cheshire, by forcing blood into it, so that in a sense the tongue is turned wrong side out for the purpose of cleaning. At K we have the end of the tongue, or what is some-

times called the "spoon." Delicate hairs (they do not seem very delicate in this view) serve to assist the tongue in gathering up its sweetness and enable the liquids, by means of capillary attraction, to be drawn upward into the central groove and side ducts already spoken of. We have then four channels for the conveyance of nectar through the proboscis; viz., C, D, E, Fig. 2, when large amounts of nectar are to be gulped down, and *c d* and *s d* in G for smaller amounts.

For the information given above I am indebted to both Cowan and Cheshire, who, it seems, have drawn on others as well as from their own extended studies and investigations.

TRANSFERRING. Make all arrangements several days before if possible, so that the bees may be fully used to the surroundings, and be all at work; remember we wish to choose a time when as many bees as possible are out at work, for they will then be nicely out of the way. About 10 o'clock A. M. will probably be the best time, if it is a warm, still day. Get all your appliances in readiness, every thing you can think of that you may need, and some other things too, perhaps. You will want a fine-toothed saw, a hammer, a chisel to cut nails in the old hive, tacks; string, such as the grocers use, a large board to lay the combs upon (the cover to a Dovetailed hive will do), a table cloth or sheet folded up to lay under the combs to prevent bumping the heads of the unhatched brood too severely, a honey-knife or a couple of them (if you have none, get a couple of long thin-bladed bread or butcher knives), and lastly a basin of water and a towel to keep every thing washed up clean. Now, as I have said before, this is really, a great part of it, women's work; and if you can not persuade your wife or sister, or some good friend among the sex to help, you are not fit to be a bee-keeper.

A good smoker will be very handy; but if you have not one, make a smoke of some bits of rotten wood in a pan; blow a little smoke in at the entrance of the hive, tip the old hive over backward, and blow in a little more smoke to drive the bees down among the combs; let it stand there, and place the new hive so that the entrance is exactly in the place of the old one; put a large newspaper in front of the new hive and let one edge lie under the entrance. The returning bees, laden with pollen and honey, are now alighting and going into the hive, and rushing out again in dismay at finding it empty; we therefore want to get one comb in for them, to let them know that it is their old home. Move the old hive back a little further, in order to get all round it, and give them a little more smoke whenever they seem disposed to be "obstreperous." Some bee-keepers pry off the hive-side, and then proceed to cut out the combs, with the bees running all over every thing. Of course, this necessarily kills bees, to say nothing of the nuisance of their crawling over the ground, up your trousers-legs, etc. A better way is to place a small box over the hive inverted, large enough to receive the whole cluster of bees. Now drum on the hive sides with a couple of sticks, or with the palms of the hands, until the bees run up into the box above. Nearly all of them can be induced to leave their combs for the box, which should be removed as soon as a majority of the bees have gone up into it, and set to one side. You can now pry off the side of the box hive, with the bees practically out of the way. On a flat board lay each comb or sheet of brood, as fast as it is cut out, and over it the frame that you are to transfer the comb into. With a sharp, keen-edged knife, mark out on the comb the size of the frame—that is, its inside dimensions. Remove the frame and then cut along the marking, after which slip the frame over. If the comb will not stay securely without any fastening, wind string a couple of times around, and tie. I recommend string in preference to transferring-clasps, transferring-wires, and every thing of that sort, for the reason that, *if* you forget to remove the strings, the bees will do it themselves, bit by bit, by the time the comb is fastened. Proceed thus until you have used up all the brood and all the *good* comb, as it does not pay, at the present prices of foundation, to use small pieces. All such should be put into the solar wax-extractor. See WAX. Pieces of comb containing brood *can* be fitted into the frames; but somehow I would manage to take in all the brood possible inside of the frame in one large piece; and little scraps that may be left had better be consigned to the solar wax-extractor. If, after all the good combs are transferred, there is still space in the hive for extra frames, put in frames of foundation to fill up.

You may now, if you have not already done so, dump your box of bees, that you have set to one side, over the top of the transferred combs, and in front of the en-

trance, and then your job is done, after you have carried away all the refuse, and made sure there are no dripping pieces of honey lying around. Should there be any chunks of good honey left after transferring, put them into a pan, to be used up at the family table. All the rest should be consigned to the solar wax-extractor, as stated.

It makes no difference which side up the brood-combs are, in transferring; turn them horizontally from their original position, or completely upside down, as you find most convenient. Store comb, in which the cells are built at an angle, would perhaps better be as it stood originally; but if you do not get it so, it makes very little difference; the bees have a way of fixing all such matters very quickly.

WHEN TO TRANSFER.

Several inquire if I would advise them to transfer bees in the months of June, July, August, etc. I really do not see how I can answer such a question, not knowing the persons. Among our neighbors there are those who would work so carefully that they would be almost sure to succeed; and, again, there are others who would be almost sure to fail. I am inclined to think those who make these inquiries would be quite apt to fail, for the careful ones would go to work without asking any questions, and do it at *any* season, if they were sufficiently anxious to have it done. Bees *can* be transferred at any month in the year. If in June or July, we shall need an extractor to throw out the honey from the heaviest pieces, before fastening them into frames. Spring, or, more exactly, during time of fruit-bloom, has been decided to be the best time, because there are then fewer bees and less honey, as a general thing, than at other times. The bees will fix up the comb better, when honey enough is being gathered to induce them to build comb to some extent, and the period of fruit-blossoming seems to secure all of the above advantages more fully than any other season.

TRANSFERRING WHEN THE BEES ARE DISPOSED TO ROB.

I have recommended the period during fruit-bloom, because at such a time the bees usually get honey enough to prevent robbing. Should it be necessary, however, to do it a little later, say between fruit-bloom and clover, use the mosquito-bar folding tent described under ROBBING.

Bring the bee-tent and all the necessary tools for transferring, and stand them near the old box hive. Drum the bees into a box as previously described. Lay on its side the box hive to be transferred, and with a cold-chisel cut the nails so that one side can be removed.[611-226] After the side is taken off, arrange every thing into as compact a space as possible. This done, step inside the tent and grasp the intersections and "spread" yourself, as it were, over your work. You will then appear like the apiarist seen below.

TRANSFERRING WITH THE TENT.

The operator inside has the old hive from which he is transferring, together with the new hive and all necessary fixtures for holding the combs in the frames. Besides these he has a saw, chisel, uncapping-knife, smoker, bee-brush, a large shallow drip-pan to catch drippings of honey, and clean wired frames. To make his work as easy as possible, he sits on a tool-box. In case he wants a frame or tool which by oversight he does not happen to have, an assistant, who may be engaged elsewhere in the apiary, at a call brings him whatever he desires. In the engraving the assistant is in the act of passing an empty comb under the mosquito-netting.

One may think that transferring in this tent is in pretty close quarters, but I have transferred in this way a number of times easily and successfully, and the tent proved no real hindrance.

A SHORT WAY OF TRANSFERRING.

A little before swarming-time, pry the top from the box hive and set a single-story hive over it, making all the joints bee-tight. Now hang frames filled with foundation in this new hive, and the bees will soon work up into it. After the queen gets to laying in these combs the bees will soon all move

up into it and you can lift it off, and transfer, or do what you please with the old hive and combs. When you are hurried, this plan gets your stock gradually into improved hives, without very much trouble, and no mussing with dripping honey.

THE HEDDON SHORT WAY OF TRANSFERRING.

The cutting of brood in transferring, prying off the hive-side, incurring the risk of robbers, and all the other incidental difficulties in the old way of transferring, suggested to Mr. James Heddon another method—one that will commend itself especially to beginners — those who dread stings and the "awful sticky" job. As foundation is now so cheap, and combs built from it are so much superior to that built naturally, and as the combs in box hives are almost universally crooked, I believe my readers will, on the whole, do better to follow the Heddon short method. Indeed, whenever we have occasion to transfer we use it exclusively.

We will assume that the hive or hives, having been received in the flat, are put together and painted, and contain frames of wired foundation ready for the bees. Light the smoker and put on a bee-veil. Move the old hive back four or five feet, and put the new hive in its place. Prepare a small box about 8 inches deep and one side open, that will just cover (not slip over) the bottom of the box hive. Turn it (the hive) upside down; set the hiving-box over it, and then drum on the sides of the hive with a couple of sticks until about two-thirds of the bees pass up into the box. Gently lift off the box containing the bees, and dump it in front of the entrance of the new hive. Make sure that the queen is among them, by watching for her as she passes with the rest into the entrance. If you do not discover her, look inside the hive. If you still fail to find her, drum out bees from the old hive again until you do get her, for, to make the plan a success, she must be in the *new* hive.

Return to the box hive and turn it right side up and set it down a couple of feet back of the new one, with its entrance turned at right angles. You now have in the hive about one-third of the original colony, the combs, and all the brood. Allow the old hive to stand for at least 21 days, at the end of which time the brood will be hatched out, with the exception of a little drone brood which will be of no value. Turn the hive upside down, and drum the remaining bees out into the hiving-box, as before. Next put an entrance-guard of perforated zinc (see DRONES) over the entrance of the new hive. Smoke the bees of the hive and then those in the hiving-box, after which dump it in front of the entrance of the new hive, as before. The smoking is to prevent the fighting on the part of the bees at the second drive, and the entrance-guard is to catch the queen or queens that have been raised in the meantime in the old hive. These one or two, if virgins, should be caught on the perforated metal and given to some queenless stocks. If the old queen in the new hive is a valuable one she should be caged at the time of making the second drive. If neither queen (the one in the old hive or the one in the new one) is valuable the perforated zinc need not be used.

The job of transferring is now completed, and all you have on hand is an old box hive containing a lot of old crooked combs, with perhaps a little honey and drone brood in it. The honey can be extracted, or used as chunk honey on the table, if fit for use. The rest can be melted up into wax, and the hive itself will make first-class kindling-wood, because it is smeared over on the inside with propolis and bits of wax.

The method above described is what is known as Heddon's short way. As it is neater, quicker, and we may say cheaper, and certainly more satisfactory in its results, we recommend it in preference to the old way.

There is one difficulty with the Heddon method: When transferring by that plan, shortly after the honey season the combs are apt to be filled with honey. How shall we get it out? After the bees have all been driven out for the last time, we may cut the combs out and extract the honey from them in pieces. But a better way is to set the box hive up 100 yards or so from the apiary, on a board, and contract the entrance so that only one bee can get through at a time, as explained at the close of the subject of ROBBING, which see. A little furore of bees may start up at first; but it soon quiets down, and in a few days the bees will take out quietly all the honey in the combs. No unpleasant disturbance follows in the apiary, for the reason that the bees get the honey slowly, about as they do from natural sources. As soon as the hive is empty of honey the bees will stop visiting it, of course, and then you can cut out the combs, put them in a solar wax-extractor, and consign the old hive to the kindling-pile.

TRAVEL-STAIN. See COMB HONEY.

TURNIP. The turnip, mustard, cabbage, rape, etc., are all members of one family, and, if I am correct, all bear honey, when circumstances are favorable. The great enemy of most of these in our locality (*especially* of the rape), is the little black cabbage-flea. The turnip escapes this pest by being sown in the fall; and were it not that it comes in bloom at almost the same time that the fruit-trees do, I should consider it one of the most promising honey-plants.

In the summer of 1877, Mr. A. W. Kaye, of Pewee Valley, Ky., sent me some seed of what is called the "Seven-top turnip," saying that his bees had gathered more pollen from it, in the spring, than from any thing else. I sowed the seed about the 1st of Oct., on ground where early potatoes had been dug. In December they showed a luxuriance of beautiful green foliage, and in May, following, a sea of yellow blossoms, making one of the prettiest "posy-beds," I believe, that I ever saw, and the music of the bees humming among the branches was just "entrancing" to one who has an ear for such music. I never saw so many bees on any patch of blossoms of its size as could be seen on them from daylight until dark.

Mr. Kaye recommended the plant particularly for pollen; but, besides this, I am inclined to think it will give a large amount of honey to the acre. We have much trouble here in raising rape and mustard, with the small turnip beetle, or flea; but this turnip-patch has never been touched; whether it is on account of sowing so late in the fall, or because the flea does not fancy it, I am unable to say. The plants seem very hardy, and the foliage is most luxuriant, much more so than either the rape or Chinese mustard, which latter plant it much resembles, only having larger blossoms. As our patch was sown after the 1st of Oct., and the crop could easily be cleared from our land by the middle of June, honey could be secured without interfering with the use of the land for other purposes.

Mr. Kaye also recommends the foliage for "greens," and says that he sows it in his garden for spring and winter use. We tried a mess of greens from our patch in December, and found them excellent. Our seed was sown very thickly, in drills about one foot apart. *This* turnip bears only *tops*, and has no enlargement of the root.

If I could get a ten-acre lot covered with such bloom during the month of August, I should not hesitate an instant to hand over the money for the necessary expenses. If we can not get the blossoms in August, we can certainly have an abundant supply between fruit-bloom and clover.

Turnip seed is valuable for the oil made from it, and also as a food for canary birds. If sown on corn-ground at the last cultivating, the plants will gain a good hold before winter, and in the spring blossom profusely. If they are turned under just before going out of bloom they make one of the most valuable of soiling crops. Thus a good turnip pasturage may be obtained with no extra work except sowing, and the crop would be an actual benefit to the soil if turned under.

U.

UNITING BEES. Uniting colonies is much like introducing queens, inasmuch as no fixed rule can be given for all cases. It is a very simple matter to lift the frames, bees and all, out of one hive and set them into another, where the two are situated side by side. Usually there will be no quarreling, if this is done when the weather is too cold for the bees to fly, but this is not always the case.[227] If one colony is placed close to one side of the hive, and the other to the other side, and they are small enough for a vacant comb or two between them, they will very rarely fight. After two or three days, the bees will be found to have united themselves peaceably, and the brood and stores may then be placed compactly together, and your chaff cushions put in at each side. If there are frames containing some honey, that can not be put in, they should be placed in an upper story, and the bees allowed to carry it down.[228] You should always look to them 20 minutes or half an hour after they are put into one hive, to see if every thing is amicable on "both sides of the house." If you find any bees fighting, or any doubled up on the bottom - board, give them such a smoking that they can not tell "which from t'other," and after 15 or 20 minutes, if they are fighting again, give them another "dose," and repeat until they are good to each other. I have never failed in getting them peaceable after two or three smokings.

If you wish to unite two colonies so large that a single story will not easily contain them, which, by the way, I feel sure is always poor policy, or if their honey is scattered through the whole ten combs in each hive, proceed as before, only set one hive over the other. If this is done on a cool day, and the bees are kept in for two or three days, few, if any, will go back to the old stand. If the hives stood within six feet of each other, they will all get back without any trouble any way, for they will hear the call of their comrades who have discovered the new order of things. Sometimes you can take two colonies while flying, and put them together without trouble, by making the lost bees call their comrades. Only actual practice, and acquaintance with the habits of bees, will enable you to do this; and if you have not that knowledge, you must get it by experience. Get a couple of colonies that you do not value much, and practice on them. As I have said all along, beware of robbers, or you will speedily make two colonies into none at all, instead of into one.

WHAT TO DO WITH THE QUEENS.

If one of the colonies to be united has been several days queenless, all the better; for a queenless colony will often give up its locality and accept a new one, if simply shaken in front of a hive containing a laying queen. From a hive containing neither queen nor brood, I have induced the whole lot to desert, and go over to a neighboring colony, by simply shaking some of the bees in front of it. They were so overjoyed at finding a laying queen, that they called all their comrades to the new home, and all hands set to work and carried every drop of honey to the hive with the fertile queen. By taking advantage of this disposition we can often make short work of uniting. If you are in a hurry, or do not care for the queens, you can unite without paying any attention to them, and one will be killed; but, as even a hybrid queen is now worth 15 cts., I do not think it pays to kill them. Remove the poorest one and keep her safely caged until you are sure the other is well received by the bees. If she is killed, as is sometimes the case, you have the other to replace her.[229] Where stocks are several rods apart, they are often moved a couple of feet a day while the bees are flying briskly, until they are side by side, and then united as we have directed. This is so much trouble that I much prefer waiting for cold weather. If

your bees are in box hives, I should say your first job on hand is to transfer them. If you have several kinds of hives in your apiary you are about as badly off, and the remedy is to throw away all but one.

In conclusion, I would advise deferring the uniting of your bees until we have several cold rainy days, in Oct., for instance, on which bees will not fly.[230] Then proceed as directed. If you have followed the advice I have given, you will have little uniting to do, except with the queen-rearing nuclei; and with these, you have only to take the hives away and set the frames in the hive below, when you are done with them. If the hive below is a strong one, as it should of course be, just set the frames from the nucleus into the upper story, until all the brood has hatched. If you wish to make a colony of the various nuclei, collect them during a cold day, and put them all into one hive. If you have bees from 3 or 4, they will unite better than if they came from only two hives, and you will seldom see a bee go back to its old home. A beginner should beware of having many weak colonies in the fall, to be united. It is much safer to have them all strong and ready for winter, long before winter comes.

UNITING NEW SWARMS.

This is so easily done that I hardly need give directions; in fact, if two swarms come out at the same time, they are almost sure to unite, and I do not know that I ever heard of two such swarms quarreling. One of the queens will very soon be killed, but you may easily find the extra one by looking for the ball of bees that will be found clinging about her, very soon after the bees have been joined together. A swarm can almost always be given without trouble, to any swarm that has come out the day previous; and if you will take the trouble to watch them a little, you may unite any swarm with any other new swarm, even if it came out a week or more before. Smoke them when inclined to fight, as I told you before, and make them be good to the new comers.[231]

UNITING BEES IN THE SPRING.

As I have pointed out elsewhere, uniting in the spring is usually unprofitable. When there are two little weak colonies, or nuclei, one having a queen, it would seem the most natural thing in the world to put the two together, for additional warmth and to provide a queen for all the bees; but, unfortunately, theory is not here borne out by the actual facts. I have united nucleus after nucleus in the spring; and while at the very time of uniting they would seem to make up a fairly good colony, yet in two or three days there would seem to be just about as few bees as there were before the uniting took place. The trouble is, that, if there is weather when they can fly, the bees that have been moved will go back to the old home to die, and, as a natural result, in three or four days there will be only the little cluster where there was a fair colony before. Uniting, when it is practiced to any advantage at all, is usually done late in the fall. But if it is not profitable to unite, what shall be done? Contract each little cluster down to one or two frames, and pack them warm. Such clusters well packed can very often be saved.

One exception should, perhaps, be made in regard to uniting in the spring; and that is, that a nucleus from an out-apiary can be brought home and united with a nucleus at the home yard, or at any other yard. There would be no returning of bees then, and the two clusters will stay together, sharing each other's heat and enjoying the privilege of having a queen over all.

V.

VEILS. The necessity of using face protections will depend very largely upon the race of bees to be handled. If one has to deal with hybrids, Cyprians, or Holy-Lands, I would recommend him to wear a veil. With pure Italians it is not so necessary, still I always prefer to have one handy. Its use will, in any case, give the apiarist a sense of security that will enable him to work to much better advantage than he would if continually in fear of every cross bee that chanced to buzz near his eyes.

There are two great objections to the use of veils; one is that they necessarily obstruct the vision more or less, and the other is that they obstruct the free circulation of air, in hot weather, and thus tend to make the wearer sweaty and uncomfortable.

The very *nicest* veil is one made entirely of silk tulle,[232] although it is somewhat more expensive. The material is so fine that a whole veil of it may be folded so as to go in a small vest-pocket. I carry one of these constantly during the working season of the bees, and it is always ready for an emergency. It neither obstructs the vision nor prevents the free circulation of air on hot days. A cheaper one, though not so light or cool, is made of grenadine with a facing of silk tulle net sewed in. It is a stronger veil, but not as cool as the one made entirely of silk tulle. The grenadine is strong, and the brussels-net facing obstructs the vision but little if any. The top of the veil is gathered with a rubber cord, so that it may be made to fit closely around the crown of the hat.

BEE VEIL AND HAT PREFERRED BY THE BOYS AT THE HOME OF THE HONEY-BEES.

Our boys wear a broad-brimmed cloth hat, costing about 20 cents each. These hats are very light, and will fit any head, and can be folded so as to put in a coat-pocket. The under side of the brim is green. The upper side of the crown is of a drab color. This broad brim is supported and held out by means of a steel hoop; and when the veil is placed over the hat, if properly drawn down it can not touch the face or neck, and hence leaves no possible chance for stings. During hot days, when bees require the most attention in the apiary, a coat or vest is simply intolerable. In the absence of either one of these the corners of the veil are drawn under the suspenders, as shown. This is much cooler than coat-collar fashion, and just as secure from the attacks of bees. When the bees become quieted down one can lift the veil up out of the way. Should he, by a careless movement, arouse the ire of his pets, he can quickly draw the veil down and pull it under the suspenders in a twinkling. But this could not be done as quickly with the coat-collar. As the crown of the hat is only cloth, on very hot days the boys are in the habit of putting plantain or grapevine leaves in the top. These are an additional protection, and keep the top of the head cool.

In some cases suspenders are not worn. In such cases a veil like that shown in the accompanying illustration can be used. This veil is made like the others, only that an elastic band or rubber cord is sewn into the bottom edges. An elastic band is next sewn on to the front with a button-hole in the end. When this hat is in use the elastic in front is buttoned to the top pants button. This holds the veil in place, suspenders or no suspenders. This suggestion comes from M. R. Kuehne, Pomona, Cal.

One of our boys has used with much satisfaction a sort of a chopping-bowl or basket

inverted. It is a hat that is worn in India and other hot countries, and is slowly working its way into this country, particularly in the South. It is made of palm-leaf, and it is supported above the head in the manner shown below. The cut will render further description unnecessary.

HOPATCONG HAT AND VEIL.

As light breezes can circulate above and around the head, it is perhaps the coolest sun-shade of any herein illustrated and described. If you can not secure one of these, and would like to get the ventilating feature, take an ordinary palm-leaf hat several sizes too large. On the inside of the hat-band sew four or five ⅜-inch corks that have been cut in halves lengthwise. These, if spaced at regular distances, will keep the hat from the head, and permit ventilation.

CAPEHART'S GLASS-FRONT VEIL.

I have before remarked, that one objection to bee-veils is the obstruction to the eyesight. To overcome this, Mr. John C. Capehart, of St. Albans, West Va., has glued a piece of glass in front of the veil. The difficulty with this was, that the glass would hardly ever be in range with the eyes, on account of its weight, and then it would be covered with steam from the breath; and, worse than all, it would get broken. The brussels net is open to none of these objections, and it is almost as transparent as glass itself.

Mr. J. H. Martin, now, 1902, of Cuba, in *Gleanings* for March 1, 1889, illustrated and described not only his bee-hat, but his bee-suit. His description and illustration are as follows:

In a clothing-store I found what is called an engineer's suit — overalls and short coat, or blouse, made of blue and white checked cotton cloth, the whole weighing only 1¼ lbs.—cost "zhust von tollar, zhust a fit, and zhust the thing." The beauty of this suit is the certainty of complete protection to your Sunday

J. H. MARTIN'S BEE-SUIT.

clothes if you choose to wear them; and the price enables you to own two suits, and wash often, and to be always clean. Then there are plenty of pockets, fore and aft, for pencils, jack-knives, screw-drivers, queen-cages, toothpicks, etc. There are those who may possibly object to appropriating or adapting an engineer's suit to bee-keeping; but, friends, if a mortal

THE PORTER BEE-VEIL.

man or woman, conducting an apiary of two hundred colonies of bees, isn't an engineer, who else, indeed, is worthy of the name? When extracting honey, or at work with stickiness that is certain to get on my arms, I put on an additional set of sleeves.

For head-wear I prefer a stiff straw hat, with a 3½-inch brim, over which a silk brussels-net veil is worn in the ordinary way. To hold the veil snug around the neck, I prefer a stout cord with a slip noose.

In the *Bee-keepers' Review* for April, 1894, Mr. Hutchinson thus describes the bee-veil, and how used by Mr. Porter, of bee-escape fame. The picture is a very natural likeness of Mr. Hutchinson himself, the editor of the *Review*.

In a hem in the bottom of the veil run a string, leaving about a foot of the hem, right in front, unoccupied by the string. That is, let the string enter the hem at about six inches to the right of the center of the front; pass it around the back of the neck, bringing it out of the hem at a point six inches to the left of the center. The projecting ends of the string must be long enough to pass under the arms, cross at the back, and then be brought around and tied in front. The string holds the edge of the veil securely out upon the shoulders; while, if the right length of hem is left without a string in front, that part will be drawn snugly across the breast.

Mr. W. L. Coggshall, of West Groton, N. Y., an extensive bee-keeper, having 3000 colonies, in *Gleanings* for June 1, 1889, described a similar suit. He says of it:

COGGSHALL'S BEE-DRESS.

My idea of a bee-veil is shown in the accompanying photograph. It is simply a wide-rimmed straw or leghorn hat, with a stiff rim—I right here went and got my hat to give you the measurements. The rim of the hat is 4 in. wide; the length of veil, up and down, 18 in., and the material is bobinet, or millinet, black. I sew the veil on the under side of the rim of the hat, 2 in. from the outer edge of the rim, thus giving a 2-in. projection to shade the veil, so that I can see at any time; for if the sun strikes the veil, I can not see eggs in the cells. I use a flat shoestring for a shir, or take-up, around the neck, and have all of the gathering in the sides and back of the veil. I sew the veil fast to the string. The shoestring is long enough to tie under the collar, so it is impossible for a bee to get at your face. There is not much gathering in front to obstruct the vision.

When I am not in the bee-yard, or going from one apiary to another, I untie and tuck it in the crown of the hat, and it is out of the way, and all ready at a moment's notice, which we all know is very convenient sometimes.

For hand-gear or false sleeves I use colored shirting. After they are made, dip them in linseed oil; hang them in the sun till dry, then the bees can not sting through them. I have a rubber elastic in the upper end above the elbow, also the one that is around the hand. Have a thumb-hole worked in above the elastic, so that the hand is all covered, except the fingers and thumb (like a mit), only the fingers are all together. With sleeves made in that way, bees do not crawl up my arms and make me uncomfortable, and give me pain. W. L. COGGSHALL.

West Groton, N. Y., April 21, 1889.

Mr. Martin and Mr. Coggshall both make use of sleeve-protectors. Both will be found exceedingly useful for protecting the hands and wrists, and they prevent them getting daubed.

THE GLOBE BEE-VEIL.

This is a veil that has had a very large sale, and it is preferred by a great number,

because it is large enough to sit clear down over an ordinary hat or cap; and it is so constructed that it can not possibly get against one's face at any point. Sometimes an ordinary veil will touch one's nose or the back of his neck. At these points a bee can, if it will, insert its sting through the meshes of

MRS. HARRISON'S BEE-HAT.

the veil. The globe veil is made so as to fold up in a small compact compass, so it can be carrried in the pocket. If one has cross bees to handle this is by all odds the best veil in the lot.

Mrs. L. Harrison, of Peoria, Ill., uses a bee-hat like the one illustrated above. The hat is made of green wire cloth; the top of pasteboard, and the bottom of calico.

MRS. R. H. HOLMES' BEE-HAT.

Mrs. R. H. Holmes, of Shoreham, Vt., uses a bee-hat like that shown in the above cut. It is simply a straw hat with a broad rim, the veil being made of mosquito-bar, and the facing of brussels net. A strip of cloth lines the lower edge of the veil, and is made just large enough to fit snugly around the shoulders. A couple of cloth straps hitched to buttons pass under the arm-pits,

A BEE-APRON FOR LADIES.

and button on behind. Of the veils for women, which we have shown, this one seems to me to be more desirable. Mrs. Harrison's hardly gives protection enough from the sun.

The cut below represents an apron preferred by Miss Emma Wilson, of Marengo, Ill. It has two large pockets. The pattern, No. 3696, can be obtained of the Butterick Publishing Co., of New York. This apron is large enough to cover the whole dress, with the exception of the sleeves. But detachable sleeves, something like those used by Mr. J. H. Martin, or Mr. Coggshall, as shown in the engravings, pp. 342, 343, are preferred. Miss Wilson prefers to wear gloves, as does Mrs. Harrison. The gloves which seem to be preferred are something in the kid or dog-skin line. Rubber gloves do not seem to answer the purpose very well.

HOW TO GET ALONG WITHOUT A VEIL.

It is a very great convenience to be *able* to dispense with a veil altogether, when circumstances call for or permit it. The only obstacle in the way is a natural dread that a bee may possibly sting in the face if it has a chance. This dread has usually to be worn off as you become more and more accustomed to handling and working with bees. When you are without a veil, if a bee comes up, and, by its hum, you detect that it is angry, do not dodge or strike at it, but control the muscles of the face as perfectly as though you were not at all aware of its presence. A little wince of the cheek or of the eye will encourage its fighting qualities. A careless, indifferent behavior, on the other hand, shows it you are not afraid of it, and it therefore very sensibly concludes that there is no use in wasting a sting for nothing. Sometimes I put my hand up to my face when one of these rascals persists in its annoyance. Should it actually begin to sting, I smash it. In your community you will probably acquire the reputation of a bee-keeper, and, as such, when you are suddenly called upon to hive a swarm of bees without preparation, for a neighbor, it would be a little unbecoming, and perhaps a little humiliating, for you to show signs of fear. You should learn to "astonish the natives" barehanded and bare-faced, and you need not incur risk, either, if you manage rightly.

VENTILATION. Bees get it, ordinarily, through the entrance, and through the cracks and crevices which are generally found in even the best-made hives, providing

the hive is properly constructed in other respects considered under the head of WINTERING. I do not believe in holes made in different portions of the hive, and covered with wire cloth, because the bees persistently wax the wire cloth over, just as soon as they get strong enough to be able to do so. If we omit the wire cloth, they will, in time, build the holes up, by much labor, with walls of propolis, until they have effectually stopped the inconvenient drafts that the improved (?) ventilators would admit at all times through the hive. During extremely hot weather, a powerful colony may need more air than is afforded by an ordinary entrance, especially if the hive stands fully in the sun. In such a case I should much prefer giving the bees shade, to cutting ventilation-holes, which the bees will soon begin to use as entrances ; and when the hot weather is over, and it is desirable to close these entrances, you confuse and annoy the bees by so doing.* On this account I would give all the ventilation that a strong colony might need to keep them inside at work in the boxes, by simply enlarging the entrance. This can be done very readily with the Dovetailed or Danzenbaker hives, and in summer we make it a practice to give the large entrances. See ENTRANCES. The chaff hive with its entrance 12 in. by 1 in. has always had all the ventilation it seemed to require, because the sun can never strike directly on the walls of the apartment containing the bees and honey. During winter this 12x1 inch should be cut down to about 6x⅜ inch. Too much ventilation in winter is too much of a good thing. The chaff cushions placed over the bees in winter are kept over the surplus frames for the greater part of the time in summer, to confine the heat during cool nights; and from their porous nature they allow of the escape of more or less air that comes in slowly through the entrance, the honey-boxes having no other covering than the wide frames that hold the sections and these same chaff cushions. I have obtained more surplus honey with this arrangement than with any other, and am firmly persuaded that a great loss of honey often results from allowing such a draft of air through the hive that the bees can not work the wax, unless during the extremely warm weather. To test this matter I covered a large colony in the house-apiary with woolen blankets while they were gathering clover honey, to induce them to remain in the boxes, even after the weather had turned quite cool. So long as the blankets remained on, the bees would remain in the boxes working wax; but as soon as the blankets were removed, at each time the experiment was tried they retreated to the body of the hive. The same thing was tried with thin-walled hives out of doors.[233]

*A colony in a chaff hive with a full-width entrance winters best.

SMOTHERING BEES BY CLOSING THE ENTRANCE.

Although bees will make out to get along, even with a very small entrance, we should be very careful about closing the entrance entirely, in warm weather, even for only a few minutes. Many are the reports we get almost every season, of bees destroyed by simply closing their entrance, while undertaking to stop their swarming for a few minutes, until some other colony can be attended to. See SWARMING, ENTRANCES, and ROBBING, especially the last head, *How to Stop Robbing.*

When bees have the swarming fever, as a general thing they are gorged with honey, and in a feverish state. They are like a man who has been taking violent exercise after a hearty meal, and require more than an ordinary amount of air. Their breathing-tubes are in different parts of the body, under the wings and on each side of the abdomen (see ANATOMY OF THE BEE); and as soon as the entrance is closed, they crowd about it; and when the heat of so many becomes suffocating, as it will in a very few minutes, the honey is involuntarily discharged, wetting themselves and their companions, and most effectually closing their breathing-tubes, in a way that causes death to ensue very quickly. I have known of heavy swarms being killed in the short space of fifteen minutes, when the hive was thus closed on them. The heat generated by the smothering mass will often be great enough to melt down the combs, enveloping bees, brood, honey, and all, in a mass almost scalding hot. Bees are sometimes smothered in this way, in extremely hot weather, even when they have very large openings covered with wire cloth. In fact, I have once or twice had bees, when shipped by railroad, in July and August, get hot and smother, when the whole top of the hive was covered with wire cloth. I took a lesson from this, and put wire cloth over both top and bottom of the hive, and then put inch strips across, so the hive could not be set down in such a way as to cover the bottom. When thus prepared, I have sent the heaviest colonies, during the hottest of summer weather, with hives full of honey, and had no trouble. See MOVING BEES.

HOW BEES DO THEIR OWN VENTILATING.

If you watch a colony of bees during a warm day, you will see rows of bees standing around the entrance, and clear inside of the hive, with their heads all one way, all making their wings go in a peculiar manner, much as they do in flying; but instead of propelling their bodies along, they propel the air behind them, and a pretty strong " blow " they get up too, as you may tell by holding your hand near them. Well, if the air is very hot and close inside the hive, so much so that there is danger of the combs melting down, they will manage so as to send cooling currents clear to the furthest parts of the hive, and even up a small hole into honey-boxes, where honey-boxes are made after such old-fashioned patterns. This idea is not by any means new, and those who have invented patent ventilators will tell us, with a very fair show of reason, how many bees are thus employed blowing through the hive, that might just as well be out in the fields gathering honey. I once thought so, and that ventilators were needed; but after watching the matter longer, I concluded the harm done by excessive heat was far less than that from cold drafts when they were not needed, and that it is better to let a few of the bees waste some time in the middle of the day, than to have comb-building stopped entirely at night, on account of the drafts given by these thoroughly ventilated hives. The most prosperous colony I ever owned was one that was so completely enveloped in chaff that they sent a stream of warm air out of their hive during frosty nights in March, strong enough to melt the frost about one side of the entrance. Of course, a stream of cold air went in at the opposite side, as fast as the warm air went out. When I can get a hive into this condition of things, they always prosper; and it is on this account that I would have no other arrangement for ventilation than that furnished by the entrance.[615] See WINTERING.

VINEGAR. This is one of the legitimate products of honey; and when properly made it has a quality that is superior to any other vinegar, especially for making pickles. It will not die, nor lose its strength like most other vinegars; and one can have light or dark vinegar by taking light or dark honey to make it from—at least so says R. R. Murphy, of Fulton, Ill., who has made and sold large quantities of honey vinegar. Speaking of pickles made of honey vinegar, Mr. G. W. Gates, of Bartlett, Tenn., says: "We have used no other for two years; and nearly every one who tastes our pickles asks my wife for her recipe for making them. When told that we use nothing but honey vinegar, they are surprised." Mr. E. France, of Platteville, Wis., asked the wife of one of the merchants why she always bought his vinegar; and her reply was, that the stuff from the store always ate up her pickles; but that, when she uses honey vinegar, her pickles keep, and have a beautiful fine flavor.

Notwithstanding the fact that vinegar from honey is the finest in the world, the very low price of the ordinary product from cider makes it impossible to get a very high price for honey vinegar. The length of time it takes to make it, and the quantity of honey required, would make the vinegar too high-priced to compete with the other articles on the market. But every bee-keeper always has some of the poorer grades of extracted honey, some from broken combs, washings from honey-barrels, honey-cans, etc., that will be practically wasted except for some such use as vinegar. Mr. E. France, of Platteville, Wis., always uses the washings of his honey-barrels; and this sweetened water he converts into vinegar. When we can utilize honey that would practically all go to waste, and convert it into cash, we are just that much ahead.

HONEY VINEGAR, HOW TO MAKE.

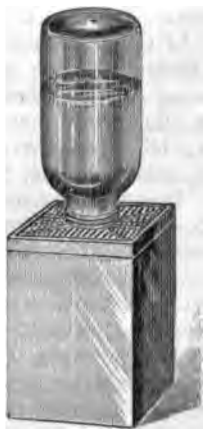
The honey-water and honey-washings should be put into a barrel or barrels with the top head taken out. To determine whether the water is sweet enough, put in a fresh egg. If the egg will just float so as to leave a spot above the liquid, about as big as a ten-cent piece, then it is "about right," according to E. France. Another bee-keeper, Mr. G. D. Black, of Brandon, Ia., uses an ordinary hydrometer, which he says he bought for 35 cents. When this sinks into the liquid so the scale registers at 11, it is of the right consistency. Next cover the top of the barrel with cheese-cloth, and let it stand in a warm place where it can work and sour. In winter it should be put into the cellar. It will take anywhere from one to two years to make good vinegar. But the process can be greatly hurried by putting in "mother" from another barrel.

VIRGIN QUEENS. See QUEENS.

W.

WATER FOR BEES. That bees need water, has been pretty well demonstrated; but the best means of supplying them has not been very satisfactorily settled. The amount of water needed depends much on whether they are rearing brood in considerable quantities or not, and whether their food is old, thick (possibly candied) honey, or new honey right from the fields. If the latter, it contains usually a large quantity of water that must be expelled before the honey can be considered ripened. See HONEY; also VENTILATION. While the bees are gathering this thin, raw honey, as a matter of course they will not need much water, if any at all, besides what the honey affords them. This new honey is frequently so thin that it runs out of the combs like sweetened water, when they are turned horizontally; and when tasted, it seems, in reality, but sweetened water. The excess of moisture is probably — I say probably, for I do not know that we have positive proof on the matter — expelled by the strong currents of air the bees keep circulating through the hive, which take up the watery particles, and speedily reduce the honey to such a consistency that it will not sour. If you will examine a hive very early in the morning during the height of the honey season you will find the blast of air that comes out, quite heavily charged with moisture; and when the weather is a little cool, this moisture often condenses and accumulates on the alighting-board, until it forms a little pool of water. Where the alighting-board was of the right shape to retain the water, I have seen it so deep as to drown bees in passing out. These bees, it would seem, at least, were in no need of water.

Admitting that bees need water at other times, how shall we give it? If there is a creek or a pond within a few rods of the apiary I would not fuss to make any watering-place for the bees, as, nine times out of ten, they will ignore that which we prepare for them. But where there is no water-trough, creek, or pond within easy reach it way be well to give the bees two or three watering-places in or near the apiary. The best arrangement is a grooved board, over which may be inverted a glass or stone jar, as seen in the accompanying illustration. The water will run down and fill the grooves as fast as the bees take it up, on the atmospheric principle; but as it is difficult to make such a board, one can, in lieu of it, use a dinner or pie plate. Fill the jar full of water; lay



WATERING-JAR AND BOARD, OR OPEN-AIR FEEDER.

across its mouth two strips of wood ¼ inch thick and ¼ inch wide. On top of this set the plate, upside down. Place the right hand on the bottom of the plate, then with the left hand grasp the jar. Now invert the whole thing. The water will bubble out immediately till the plate has a depth of water of about ¼ inch, or whatever the thickness of the sticks is. Set the device in a convenient place near the apiary; and to prevent the bees from drowning lay little strips of wood in the water. If this water has been previously salted a little it serves as an ad-

ditional attraction. Several of these jars may be placed in and about the yard.

But let it be distinctly understood that it is entirely unnecessary to go to all this trouble, providing bees can get water in abundance from some pump, creek, or pond, as mentioned. If, however, there are neighbors who complain about the bees congregating about their pumps or troughs, it may be well to fix up a counter-attraction in the way of jars of water that has been slightly salted, to draw the bees away. In addition to this, take a pail of water and put into it a tablespoonful of commercial carbolic acid. Stir it well, then spray or spatter this water around the pump of your neighbor who complains of your bees. As explained under ROBBING, bees seem to have a great aversion to carbolic acid; and where a solution of it has been placed they will keep entirely away.

WAX. This is a term that is applied to a large class of substances very much resembling each other in external characteristics, but quite unlike chemically. The wax of commerce may be divided into four general classes: Beeswax, familiar to us all; mineral wax, or by-products from petroleum; wax from plants, and wax from insects other than bees. But the first two are by far the most important, commercially, in this country. Of the mineral waxes we have what is most common, viz., paraffine and ceresin. Beeswax, the most valuable, has a specific gravity of between 960 and 972, and a melting point of between 143 and 145° F. The mineral waxes vary so much in hardness, melting-point, and specific gravity, that it would be useless to name exact figures. As a rule, however, it may be stated that the fusing-point of paraffine is much below that of beeswax, while that of ceresin may be either above or below, or practically the same; and the fusing-point may be also very near or the same as that of beeswax. In general, we may say that the specific gravity of both commercial paraffine and ceresin is below that of beeswax; and this one fact renders it an easy matter to detect adulteration of beeswax with either paraffine or ceresin, by a method that will be explained further on, under the head of ADULTERATION OF BEESWAX.

There are also known in commerce such as Japanese wax and China wax, both of which may or may not be the product of insects or plants; but as they are so much more expensive than either paraffine or ceresin, little fear need be entertained of their being used as an adulterant of beeswax.

BEESWAX.

For the use of bees and bee-keeper, no product has ever been discovered that can take the place of that which the bees themselves furnish. Real beeswax itself will retain its ductility and tenacity under greater ranges of temperature than any mineral, plant, or insect wax. Combs made of foundation containing 25 to 50 per cent of adulterations of paraffine or ceresin are very liable to melt down in the hive in hot weather. While paraffine is ductile enough to make beautiful foundation it will not stand the heat of the hive. Ceresin, on the other hand, while more closely allied to genuine beeswax in point of specific gravity and fusibility, is too tough and brittle, under some conditions, for bees to work. Work it? Yes, they *will* do it, and construct combs; and in Germany I understand that considerable ceresin foundation has been sold, and is, perhaps, being sold now; but our experience leads us to believe that it is poor economy, and will lead the bee-keeper or the poor bees to grief sooner or later. Practically, then, we can say that real genuine pure beeswax is the only product that can or ought to go into foundation; and I am glad to say that it is the only article that foundation-makers in this country use.

HOW THE BEES "MAKE" WAX.

If you watch the bees closely during the height of the honey-harvest, or, what is perhaps better, feed a colony heavily on sugar syrup for about 3 days during warm weather, at the end of the second or third day, by looking closely, you will see little pearly disks of wax, somewhat resembling fish-scales, protruding from between the rings on the under side of the body of the bee; and, if you examine with a magnifier, you will find these little wax cakes of rare beauty. Sometimes, especially when the bees are being fed heavily, these wax scales will fall down on the bottom-board and may be scraped up in considerable quantities, seeming for some reason not to have been wanted. During the seasons of the natural secretion of the wax, if the colony has a hive affording plenty of room for surplus, we believe these wax scales are seldom wasted. At the swarming-time, there seems to be an unusual number of bees provided with these wax scales; for, if they have remained clustered on a limb for only a few minutes, bits of wax are found attached, as if they were going to start comb.

When they are domiciled in their new hive, comes the time, if the hive pleases them, for them to show their astonishing skill and dexterity in fabricating the honey-comb.

So much for the different kinds of wax and their sources; but what will interest the average bee-keeper is how to render up odd bits of wax, old combs, etc., into nice cakes suitable for market, and to this we shall now give our attention.

HOW TO RENDER WAX WITHOUT AN EXTRACTOR.

Get an ordinary wash-boiler that sinks into the fire-place of the stove. Put some strips of wood across, to keep the bags of wax from resting on the bottom, and burning. These strips are to be of such length that their ends rest on the ledge of the bottom part of the boiler. We have been using one made of wire cloth, but it is hardly stiff enough. Have some bags made of coarse strainer cloth, such as is known in the dairy regions as cheese-cloth. These should be about the size of grain-bags, but not as long. Squeeze your wax into balls in the hands, getting it into as small a compass as may be, and put it in the bags. Have bags enough to contain all the wax. These bags cost very little, as the cloth is only 6c. per yard. When you have as many packed into your boiler as you can get in, while the water is boiling, put on a board, with a heavy piece of iron on it. When the wax is all pressed out of the bags, the iron should be beneath the surface of the liquid; if it is not, add more water, or make the weight sink deeper. The wax, of course, is found swimming on the surface, and may be dipped off. The more compactly the wax is put into the bags, the less number of bags will be needed.[619]

Where one has cappings from the extractor, they should not be put with old dark combs, but worked by themselves, for they are almost pure wax. For this purpose there is nothing better than the solar wax-extractor. I have seen cappings from new white combs produce wax so nearly white that it would readily sell for bleached wax.

The wax of commerce, when it is bought in quantities, is composed of cakes of all sizes and of all colors, from nearly white to nearly black, the intermediate shades comprising almost all the colors of the rainbow. Where it contains much refuse, it can be improved by putting it through the solar extractors described further on, and, in fact, almost any wax can be made cleaner and brighter by being put through the extractor two or three times. But a far better way is to refine it by means of sulphuric acid, described further on.

SOLAR WAX-EXTRACTORS.

It is said the sun wax-extractor first originated in California about the year 1862. At this time it was used for the purpose of extracting honey from the combs. The honey-extractor of to-day was then unknown, and so it is related that the early Californians extracted their honey largely by means of the sun's heat. They simply placed their cards of comb in large trays covered with glass, where old Sol, by the mere beaming of his countenance, did the work. As the combs melted, the honey and wax ran together, into a receptacle. In the evening, the wax, by reason of its lighter weight, was hardened and floating on the surface of the honey. The Californians thus practically accomplished two objects at one and the same operation, the extracting of both honey and wax—the latter already in marketable shape. As to the quality of the honey so separated from the combs, it is much better than one would suppose, but inferior to the ordinary extracted. Recently the use of the solar wax-extractor has been restricted to the melting of wax only.

To a casual observer it seems almost incredible that wax can be melted by the aid of old Sol. It is well known to the bee-keeper, that little scraps of wax in summer weather will melt on a hive-cover exposed to the direct rays of the sun. If, therefore, we cover a shallow box with a sheet of glass, and place therein a piece of comb, said piece will utilize a much larger percentage of heat. Still further, if we collect more rays of the sun, and cast them into the box by means of a reflector (a sheet of tin, for example) a correspondingly greater increase of temperature may be expected. The reflector, however, is unnecessary, as sufficient heat is obtained without it.

THE DOOLITTLE SOLAR WAX-EXTRACTOR.

This machine has had a very large sale. Its general design is after a pattern made and used by the well-known bee-keeper G. M. Doolittle. The only objection to it is that it is rather small; but it is just the right size to take pieces of burr-comb, and other bits of wax, etc., that accumulate in every-day working of the apiary. These accumulations can be thrown into the machine whenever one happens to pass by it: and instead of having a lot of little pieces scattered here and there through the apiary, to be

melted up at some future time, they may be converted at once into a marketable product.

DOOLITTLE'S SOLAR WAX-EXTRACTOR.

But these small machines are not suitable for melting up combs. For that, something as large as the Boardman should be used, described further on.

THE RAUCHFUSS SUN WAX-EXTRACTOR.

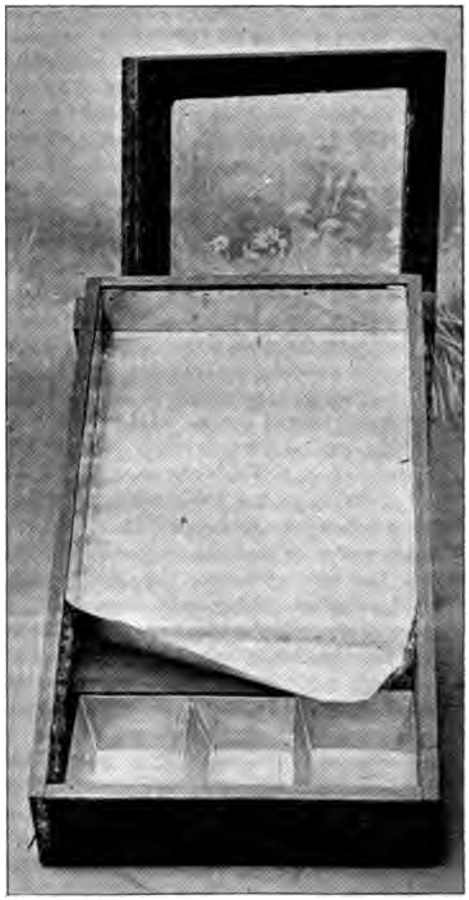
Mr. Frank Rauchfuss, of Denver, Colo., made an improvement. Instead of having the wax run into a single pan as in the case of the Doolittle, he has the pan so arranged

THE BOARDMAN SOLAR WAX-EXTRACTOR.

that the lip is turned toward the right, delivering the wax in the right pan. This pan catches the impurities; and as it is deeper it overflows into pan No. 2. When No. 2 is full this overflows in turn into No. 3. When the wax is cold it is in neat marketable shape, without further melting; and if the wax is not dirty in the first place, that in pan No. 1 will be fit for market; but if there is any dirt it will all be on the bottom of the cake, and may be scraped off, leaving the cake as clean, practically, as the other two. The bee-keepers of Denver and vicinity have tried this extractor, and much prefer it to the other form shown.

THE BOARDMAN SOLAR EXTRACTOR.

This is built very much on the same general plan as the one just described, but is larger. The rockers, or runners, afford facility for transportation, and also for tilting the machine at the proper angle to the sun. Common greenhouse sash may be used; but a large glass, say 30 x 60, is better, for the reason that the sash cut off a good deal of



THE RAUCHFUSS SOLAR WAX-EXTRACTOR.

the sun's rays, and make shade-lines, along which the wax fails to melt.* The size of glass that one is able to buy will, of course, regulate the size of the extractor: the depth

*If I could not get the large glass I would purchase three sheets of 20x30, and put them in the frame crosswise—the glass butting tight up against each other.

of the box, or tray, may be anywhere from 6 to 8 inches. The bottom is made up of cheap lumber. This box or tray should be lined with common black sheet iron. Tin should not be used, because that would reflect back too much of the sun's light. The whole tray, including the frame for the glass, should be painted black; and the glass, while the machine is in use, should be kept scrupulously clean.

SOLAR WAX-EXTRACTORS NOT SUITABLE FOR OLD COMBS.

Solar wax-extractors have their use. While they will handle *new* combs, particles of fresh wax, pieces of burr-combs, and the like, and while they can be used to clarify and bleach to a certain extent wax already caked, they are not adapted to the handling of old black combs that have several generations of cocoons in them. The large sun extractors, like the Boardman, will get the bulk of the wax out of such combs, but they do not get *all* of it. If sun heat is used at all for melting, the slumgum (or refuse) should be further treated in hot water, and then subjected to a pressure. But, better still, such old combs should be put, in the first place, into a regular wax-extractor so constructed that a pressure can be exerted to squeeze out of the cocoons every particle of wax.

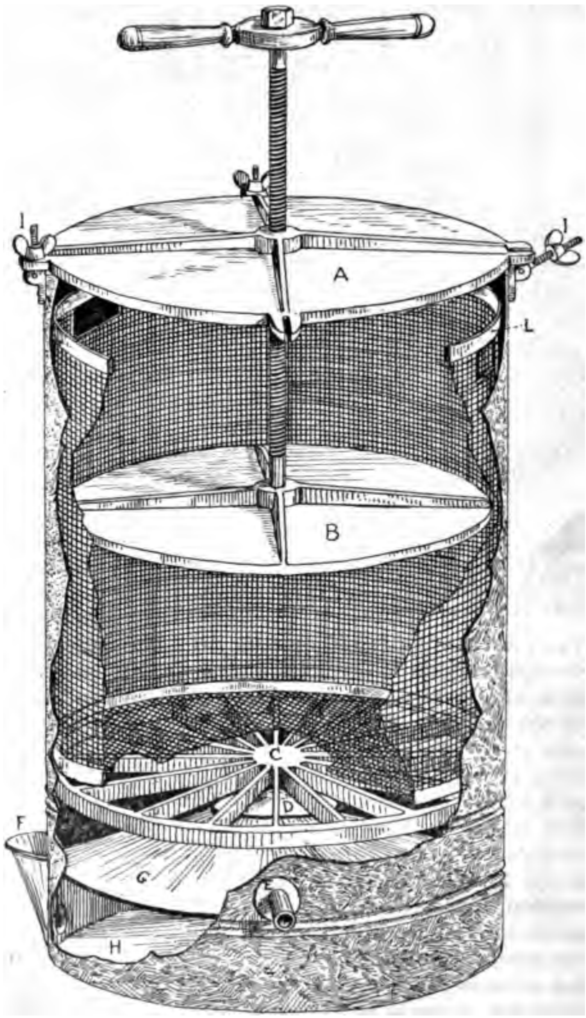
WAX-PRESSES VARIOUSLY CONSTRUCTED.

There are several different styles of presses, each having its own advocates; but they may all be divided into three general classes: First, a machine to squeeze the combs while enveloped in hot steam; second, one for producing the requisite pressure of the combs in hot water; third, one having the general design and style of a cheese-press, but in which the cheese (compressed refuse) is enveloped in *neither* hot water nor steam. In the case of the last named the combs are melted in hot water, put into a cheese cloth sack, and quickly put into the press, and squeezed in the open air before the mass cools.

THE GERMAN STEAM WAX-PRESS.

The German presses are all of the same general design, and the one shown in the illustration has had a large sale throughout America.

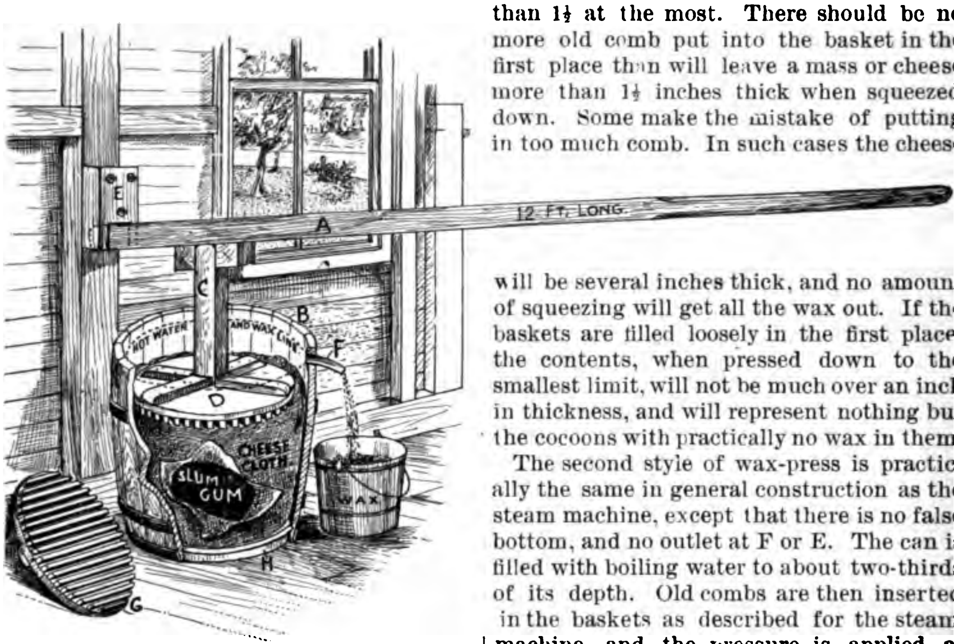
In the sectional view, H represents the bottom proper of the outer receiving-can, and which comes in contact with the top of



GERMAN WAX-PRESS—DETAIL OF CONSTRUCTION.

an ordinary cooking-stove. Water is poured into the funnel mouth at F until the lower compartment beneath G is nearly full. G is a funnel-shaped false bottom that separates the upper compartment from the lower. Through the center or apex of G is a small hole, and supported over this hole is another cone-shaped disk that prevents the wax drippings from going into the water at

H. C is a cast-iron spider riveted to the side of the can to support the enormous strain or pressure put on the bottom of the basket, from the screw. The pressure-plate



A, lever, 12 feet long; B, half-barrel; C, standard; D, cleated pressure-disk; E, block, bolted to house; F, spout for wax as on top of hot water. Dotted line shows hot water and wax line. H, loose piece of wood to prevent the bottom from being pressed out. G, under side of D, showing cleats.

B and A, with the screw, are removed. The wire-cloth basket L has tucked in it a square piece of cheese-cloth that has first been soaked in water. The basket is then filled with pieces of old comb, when the cloth is folded back over. The screw is then raised so the pressure-plate B is up against A. A is then placed in position, and secured by lugs I I. The machine is next set on the cook-stove, and a good fire started. After the steam is generated it will pass upward through the false bottom G through the hole in the center and under plate D. As steam rises it passes all through the mass of comb, melting it, causing the melted wax to drop down on the false bottom D and G, and finally out at the spout E. When the wax has nearly stopped running, pressure is applied by means of the screw, the plate B being forced downward until the mass of slumgum is an inch or two thick—not more than 1½ at the most. There should be no more old comb put into the basket in the first place than will leave a mass or cheese more than 1½ inches thick when squeezed down. Some make the mistake of putting in too much comb. In such cases the cheese will be several inches thick, and no amount of squeezing will get all the wax out. If the baskets are filled loosely in the first place, the contents, when pressed down to the smallest limit, will not be much over an inch in thickness, and will represent nothing but the cocoons with practically no wax in them.

The second style of wax-press is practically the same in general construction as the steam machine, except that there is no false bottom, and no outlet at F or E. The can is filled with boiling water to about two-thirds of its depth. Old combs are then inserted in the baskets as described for the steam-machine, and the pressure is applied as before explained. But the great objection to hot water squeezing is that the free wax rises to the top of the water, where it is difficult to remove it. The hot-water machines are in no way superior to the steam-presses, and are much more inconvenient to handle, and, as a rule, should not be considered, on account of the extra labor involved. Still,

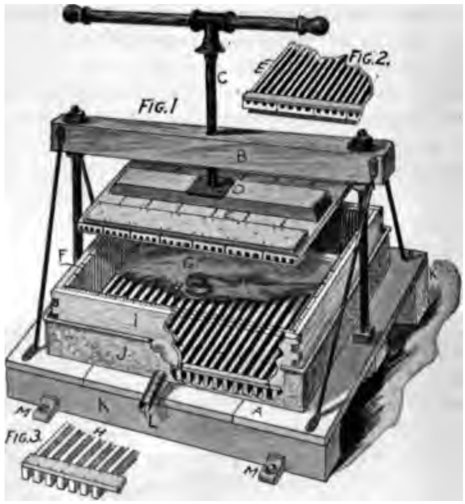
THE ROOT-GERMAN STEAM WAX-PRESS.

there are times and circumstances when hot water will have to be employed, particularly on the ground of economy. One can make use of a half-barrel or tub, wooden plunger-plate, and a twelve-foot lever, in lieu of a screw to bring about the necessary pressure. The illustration shows how such a device can be constructed out of materials found around home. The barrel should not be over two feet deep. On the inside there should be nailed perpendicularly a series of slats ¾-inch square, and about ½ inch apart, in such a way that the free wax, as it escapes from the cheese, can escape and pass upward to the surface of the water. The bottom should be ribbed in a like manner. Spread over the inside of the barrel a large square piece of cheese-cloth. Pour in the refuse combs till the barrel or tub is about two-thirds full. Fold the edges of the cheese-cloth over; insert the plunger-plate D, with its standard C. Place the barrel up close to the side of the building, and pour in two or three pailfuls of hot water. Let it stand a few minutes, then apply pressure by means of the twelve-foot lever. Put a bag of sand, or any other convenient weight, on the extreme end of the lever. On the final squeeze put your own weight along with that of the above weight, after which remove the lever and plunge-plate and standard C D. Dip or pour off all the wax and the water, for there will be an intermingling of the two, and set in another vessel to cool. When cool, the cake of wax can be lifted off from the water in one solid piece. But when filling the barrel again with more comb, do not put in enough so that the refuse, when squeezed down, will be more than 1½ inches thick. This is important. If the slumgum is four or five inches thick after putting your weight on the lever, and that of the bag of sand in addition, you will find there will be a good deal of wax left in the cheese. It should never be more than an inch thick to get all the wax out.

THE HATCH-GEMMILL WAX-PRESS.

The accompanying illustration shows a press that has been used to a considerable extent. The fine print below the illustration will show the mechanical construction. The screw itself is an ordinary carpenter's bench-vise screw that can be obtained at any hardware store. The galvanized iron tray J can be made at any tin-shop. The box I is an ordinary wooden rim of ¾-inch stuff without bottom or cover, about 6 inches deep, and of such a size as to go inside of the pan. On the inside of the wood rim thin pieces of grooved boards are nailed, F, as shown. The bottom is made up of a series of slats nailed together as indicated in Fig. 3, and slips down easily into the tray I. The under side of the plunger-plate E is slatted in a like manner. The purpose of these grooves is to allow the wax to escape out of the cheese, and run down to the bottom, and finally escape at the spout L.

Its manner of use is as follows: The old comb is melted in an iron kettle outdoors, or in a wash-boiler in the house. In either



THE HATCH-GEMMILL WAX-PRESS.

Fig. 1.—A, bed, little higher at back end; B, beam for screw and braces; C, hand-screw and lever; D, iron plate on follower; E, slotted bottom of follower; F, slotted sides of case; G, cheese-cloth or burlap; H, slotted bars on bottom-piece; I, case; J, galvanized tank; K, K, heavy wood foundations; L, spout; M, M, braces running through K K to bolt to the floor. Fig. 2.—Part of the follower turned bottom side up, showing E. Fig. 3.—Detail part of bottom part showing construction of H.

case the press should be very close at hand. Gunny sacking, or a kind of coarse cheese-cloth, is dipped in hot water and set inside of the tray. The cloth, or whatever it is, should be large enough to extend beyond each side and end. The comb, now melted in the boiler, is dipped off in large dipperfuls, and poured into the press. When the wooden tray is nearly full of refuse, the edges of the cloth are folded together, the plunger-plate E is screwed down at once before the mass has time to cool; the wax, as it is squeezed out, runs out between the slats, and empties out at spout L.

A good many prefer this to any other machine; but our own experience has been that the process of dipping the melted wax

from the stove to the press was very messy. Then, again, the mass is liable to get cool, or, as some express it, to "freeze," before the pressure can be applied. Still others have said that the wax will spurt out of the sides of the cheese, spattering the operator as well as the room in which the machine is placed. But those who are most familiar with the handling of the machine say there is no excuse for the freezing, spattering, or mussing.

We have tested all the machines, but find we get altogether the most satisfactory results—certainly the cleanest and nicest wax —from the German wax-press. Wax that is melted in hot water, and rises to the surface, is liable to be spongy, and the cake will be dirty on the bottom. For that reason presses employing hot water we do not recommend except to those who can not afford to buy the steam wax-press, and would, if they use any thing, be compelled to use a home-made contrivance consisting of a half-barrel and strips of wood, a 12-foot lever as described.

But one objection to the lever press is that an ordinary screw has four or five times the power of a twelve-foot lever. The lever puts a fearful strain on the floor as well as the studding or beam attached to the ceiling, and we are satisfied that the screw, by reason of the greater power it affords, will, under some circumstances, extract more wax than the lever; and it is a mooted question whether one can afford to use the home-made machine with lever when a regular steam wax-press might save enough more to pay for its use in one or two years' time.

HOW TO REFINE WAX WITH SULPHURIC ACID.

Wax cakes, as they are bought up, are usually of all grades and colors. The difference in color is due largely to the amount of impurities the wax contains. To refine this wax, or to reduce it to a lemon color, melt it in a vat of hot water slightly acidulated with sulphuric acid, in the proportion of anywhere from one part acid to from 50 to 200 by weight of water, depending upon the amount of impurity in the wax.* In all the years that we have been in the business we have found no practical or satisfactory way of bringing the wax to a yellow color—that is, to its original state of purity, except by treating it with acid. The best method of procedure is to fill a wooden tank or barrel a quarter full of water. Into this put by weight a quantity of acid—if the cakes to be rendered are of about the average run, one part of acid to 100 parts of water, and heat this water to about 180° Fahr.: and the only practical way in a *wooden* tank is by means of a steam-pipe introduced from the top. Put in the cakes of wax and fill the tank level full. As the wax melts it will leave the tank about three-fourths full of melted wax, water, and acid. Let the water and wax simmer until they are thoroughly mixed; and this will take, usually, about half an hour; but be careful that the wax does not boil over. To prevent this the quantity of steam should be gradually cut off. The steam-pipe should now be drawn out, and the tank covered with an old cloth or carpet, and should be allowed to stand as many hours as the wax will remain liquid, or about half a day. At the expiration of this time the water and acid will have settled to the bottom by reason of their greater specific gravity; and the acid, in turn, having a greater specific gravity than that of water, will settle to the bottom of the water; and the consequence is, that the wax itself, after being purified, is allowed to become thoroughly cleansed of any residue of acid, and the dirt accumulation will all have settled to the bottom of the wax and into the water. The melted wax should now be dipped off very carefully from the top, and poured into any sort of receptacles with flaring sides. When the wax is dipped nearly to the bottom, or when it shows evidence of coming near the dirt, the rest should be allowed to stand. As soon as it is caked in the barrel or tank, it may be lifted out, and the dirt clinging to the bottom can be scraped off; you will thus have, as the result of your labor, cakes of beautiful yellow wax—something that will make foundation that will please the eye.

HOW TO USE SULPHURIC ACID WITHOUT THE STEAM-JET.

But suppose you do not have steam, and can not very well have access to it. In that case you can use, in a smaller way, a large earthenware kettle. Into this put a small quantity of water, then a proportionate amount of acid. Allow it to come to a boil, and put in a cake of wax.

If this is too slow and tedious a job, a large iron kettle that will hold seven or eight pails of water may be used. Fill this kettle about half full of water, slightly acidulated. Start a slow fire under it, and when the water gets to be nearly boiling put in the cakes of

*G. M. Doolittle recommends using a pint of strong vinegar in one quart of water for every ten pounds of wax. The vinegar may be used in place of sulphuric acid, but where a large lot of wax is to be rendered the acid is far cheaper.

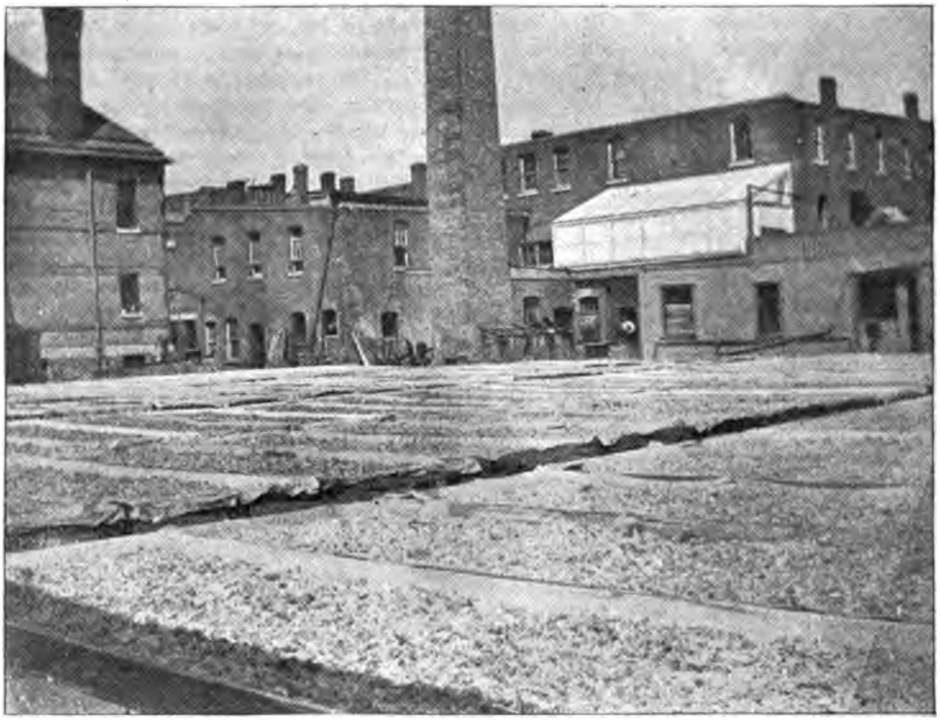
dark-colored wax that are to be brought to a bright yellow. Keep hot for a few minutes, and then allow the fire to die down. As soon as all the particles of dirt have settled in the water, with a dipper dip off the free wax on top, being very careful not to agitate or stir up the dirt in the water.

While the iron in the kettle may be attacked slightly, yet it will do no particular harm. When through with the kettle, clean it out with boiling water and rub over with grease.

BLEACHING BEESWAX.

There are methods by which beeswax can be bleached by the use of chemicals; but after some experimenting we have not been successful with any of them, and finally discovered that, for the economic uses of the bee-keeper, foundation made of bleached wax was no better than if as good as that having the natural yellow color, refined by the use of sulphuric acid as explained elsewhere. The yellow wax is more ductile, and therefore more easily worked by the bees; and even when used for section honey-boxes, the combs from yellow wax are about as white as those from the bleached; and when capped over, no one can tell the difference. But very often dealers may have a call for bleached beeswax; and the only practical way of getting it is to convert the product into thin sheets or small particles, and then subject them to the sun's rays for a suitable length of time. When sufficiently bleached it may then be melted up and caked.

The illustration herewith shown represents how it is done at a large wax-working establishment where wax-bleaching is made a specialty. I refer to the firm that was formerly Eckerman & Will, of Syracuse, N. Y., but now bearing the name of Will & Baumer Co. The wax is reduced to thin sheets or shreds, or, what is often done, is allowed to drop on a revolving cylinder, forming small chunks or drops, as it were, which immediately cool. These particles of wax, or thin sheets, are then spread on canvas trays, and then exposed to the rays of the sun until they are bleached. When the wax is first put out it packs more or less and has to be frequently showered with water, or raked over, to keep it loose so that the air and sun can get at it. If the process has been properly carried on, the finished product, when caked, will be of a pearly whiteness.



FACTORY AND BLEACHING-YARD OF WILL & BAUMER, SYRACUSE, N. Y.

At this factory of Will & Baumer Co., immense quantities of candles are made for sacramental purposes of the Roman Catholic Church; for it is well known that this church prefers pure beeswax. Some of the candles made there are of immense size. But all candles are not made of pure bees-

A MAMMOTH CANDLE FOR SACRAMENTAL PURPOSES.

wax. Paraffine is used very largely for the purpose, and the small candles that are used at lawn fetes and at Christmas times, variously colored, are probably made of pure paraffine, because that article costs less than half as much as beeswax.

HOW TO DETECT ADULTERATED WAX.

I have already spoken of the fact that beeswax is liable to be adulterated with paraffine or ceresin, and sometimes with ordinary grease or fat. Some unscrupulous box-hive bee-keepers, after brimstoning their "skeps," and melting up the wax,* add just enough tallow to increase the weight of the article, because grease is cheap compared with the ordinary product of the hive. But such adulterations are very easily detected, both by smell and by the eye. The cakes containing grease have a greasy smell, and have a greasy feeling; and then if they are subjected to the float test, which I shall presently describe, they will immediately rise to the top of the liquid. Paraffine and ceresin adulterations are not so easily recognized; but nearly all pure beeswax, when chewed in the mouth for a few minutes, will crumble up in fine particles; but wax containing a small percentage of paraffine or ceresin will chew like sealing-wax, or like ordinary chewing-gum.

But the simplest and most reliable test, is what I shall call the float test, or, to speak more exactly, the specific-gravity test. I have already stated that the specific gravities of the ordinary commercial paraffines and ceresins were below that of beeswax. As an ordinary article of pure beeswax is lighter than water (wax standing 965 and water at 1000), of course it will float when a piece of it is put into that liquid. Into a jar partly filled with water we will now pour in alcohol until a small piece of beeswax of known purity settles to the bottom, taking care not to pour in too much alcohol, for we want the wax to sink just to the bottom; that is, we desire the alcoholic liquid and the wax to be of the same specific gravity. Now, then, we will put in a piece of adulterated beeswax containing, say, 50 per cent of paraffine or ceresin. The chunk will float on the surface of the liquid. We will now take another piece of wax that contains only 10 per cent of adulteration. It still floats, but has a tendency to sink almost under the surface. If we take another piece containing only 5 per cent, it may float or gradually settle to the bottom of the jar, perhaps standing upon a single point.

For all practical purposes we have found this float test to be entirely reliable; that is, it has so far shown us unerringly every adulterated sample. I remember particularly one instance when quite a large shipment of beeswax was sent us. It was very beautiful, and the cakes were all of a uniform size; but the price was very low. It was suspicious, and accordingly we subjected it to the float test. Sure enough, a small piece of the wax stayed nicely on top of the test liquid without the least effort. We then put it into a liquid that would let a 25-per cent ceresin adulteration sink. After hovering near the surface it gradually sank, and behaved like the piece of wax that we knew contained 25 per cent of ceresin. We wrote to the shipper that we did not want adulterated beeswax; that we *must* have the pure article; that he had got to take the stuff off our hands. He did it very promptly, without even trying to defend himself, any more than to say that he thought we were not very particular. He knew better, but thought he could unload the stuff on us.

CLEANING WAX FROM UTENSILS.

Perhaps the readiest means is to immerse

*See Box Hives and Straw Skeps.

them in boiling water until all the wax is thoroughly melted off, then drain, while kept hot, until the wax which adheres to them when being lifted from the water is thoroughly melted, and can be wiped off with soft newspaper. Where the article can not be easily immersed, benzine or a solution of sal-soda will readily dissolve the wax, so it may be cleaned off with a cloth. Benzine dissolves wax almost as readily as water dissolves sugar.

Caution in handling wax.—I have spoken about order, care, and cleanliness, in handling honey, candy, etc.; now, my friends, it is a much more serious thing to daub melted wax about the house, on the carpets and on your clothes, than it is to daub either honey or candy. You can very easily spoil a dollar's worth of clothing while fussing with 10 cts. worth of wax, as I know by experience. When you commence, bear this in mind, and resolve that you are going to have things clean and neat at every step, no matter what the cost. Newspapers are very cheap, and it takes but a minute to spread them all around the room where your wax may be dropped. Have every thing, at every stage, in such order that you would not be ashamed of your work should visitors call unexpectedly. The greatest trials I have ever had with boys and girls, in trying to teach them neatness and order, has been with those in the wax-room; they *will* drop little bits of wax, and step on them. My friend, if you can not learn to avoid stepping on bees, or dropping and stepping on wax and honey while you are at work, you would better stop right here, and give up trying to be a bee-keeper. I do not know but you might also give up all thoughts of ever trying to be happy anywhere. You certainly can not be wanted in this world, and I am not sure you will be wanted in heaven, if you go about carelessly treading on things, and sticking and daubing honey and beeswax everywhere you go.

WEIGHT OF BEES. Some very interesting experiments were conducted by Prof. B. F. Koons, of the Agricultural College, Storrs, Ct., with a view to determine the weight of bees, and the amount of honey they can carry. The results of these experiments were given in *Gleanings in Bee Culture*, and as the article is so valuable I have thought best to preserve it in permanent form:

Some two years ago, in a leisure hour I went to my apiary and captured one outgoing bee from each hive and subjected them to the fumes of cyanide of potassium for a few moments to render them inactive, and then weighed each bee upon our chemical balances—a pair of scales so delicately adjusted that it is an easy matter to weigh the one-millionth part of a pound or the one-thousandth part of a bee. From the weight of each separate bee it was a very simple problem in arithmetic to compute the number of bees in a pound. The results showed that mine, which perhaps are a fair average in size and weight, ran from 4141 to 5669 in a pound. These results you published in *Gleanings*, and there expressed a wish that I would also determine the amount of honey carried by a homing bee. In my research for the weight of bees I took those just leaving the hive, which naturally would represent the normal weight, having no extra honey or pollen on board.

During the present summer, when the bees were very active, I have undertaken to carry out your request as to the amount of honey carried by a bee. My method was this: From the chemical laboratory I secured a couple of delicate glass flasks with corks, marking them A and B. Each was very carefully weighed, and the weight recorded. I then went to a hive, and, with the aid of a pair of delicate pliers, or pincers, I captured a number of incoming bees and dropped them into flask A. I then secured about an equal number of outgoing bees in flask B. These were then taken to the laboratory immediately, and each flask again weighed, after which the bees were carefully counted and released. This operation was repeated quite a number of times, not on the same day, but as opportunity offered, and when the bees were bringing in an abundance of honey. I captured from 20 to 45 bees for each flask at each trip, aiming to have, as nearly as might be, the same number in each flask on any particular trip. I always weighed the flasks before starting out, lest some little bit of soil or stain, or even moisture on the glass, would render the results less accurate; I also always allowed any moisture condensed upon the inside of the flasks, while the bees were confined, to evaporate before weighing for another trip. I then treated my results as follows: From the weight of flask and bees I deducted the weight of the flask; the remainder I divided by the number of bees confined on that trip. This gave me the average weight of the bees captured at that time. The average weight of the bees in flask A, or loaded bees, was always greater, as it should be, than the average weight of the bees in flask B, or unloaded bees. The difference between these two weights gave me the average amount of honey carried by that lot of bees.

Mine are Italian and hybrid bees, but I made no attempt to determine the difference in the amount carried by the different swarms or breeds. I kept no record of the swarms except that I guarded against going to the same hive for a second lot of bees. A considerable difference does appear, but probably that arises in part from the abundance or scarcity of the honey on that particular day on which the colony was visited. My aim was to secure reliable results, as nearly as possible, representing the average amount of honey carried by bees.

The following is the result of weighing several hundred each, of the returning and outgoing bees. The smallest number of bees necessary to carry one pound of honey, as shown by my results, is 10,154; or, in other words, one bee can carry the $\frac{1}{10154}$ (one ten thousand one hundred and fifty-fourth) part of a pound of honey; and the largest number, as shown

by the results, required to carry a pound is 45,642; and the average of all the sets weighed is 20,167. Perhaps, then, it is approximately correct to say that the average load of a bee is $\frac{1}{20000}$ (one twenty-thousandth) of a pound; or, in other words, if a colony has 20,000 bees in it, and each one makes one trip a day, they will add the pound to their stores. Of course, not all the bees in a colony leave the hive, the nurses remaining at home, hence necessitating more trips of those which do "go a-field."

I also repeated my observations of two years ago on the weight of bees, and found that my numbers ran from 3680 to 5495 in a pound, and the average about 4800, the same as in my former test. I likewise secured the following on the weight of drones: Of a dozen or more weighed, the largest would require 1808 to make a pound, and the smallest 2122, or an average of about 2000 drones in a pound, over against nearly 5000 workers. B. F. Koons.

Agricultural College, Storrs, Ct., Sept. 3, 1895.

In a nutshell, and speaking in round numbers, we may say that it takes 4500 bees to make a pound; and that, while 10,000 bees may carry a pound of nectar, twice that number, or 20,000, is probably more nearly the average. During basswood bloom, the first figure should be considered as the nearer correct one because the bees drop down at the entrance; and from almost all other sources of nectar the twenty-thousand mark is the one to accept.

Let us now look at these interesting figures in another way: A bee *can* carry half its weight in nectar; and perhaps, under certain circumstances, a trifle more; but, generally speaking, one-fourth its weight is the amount. A single strong colony has been known to bring in a trifle over 20 lbs. of nectar from basswood in one day;* but usually four or five pounds is considered a *remarkably big* day's work. If we figure that there were, say, in the first instance (20 lbs. per day), 8 lbs. of bees, there would be 36,000 bees. If 20,000 of these were field-bees (estimating 10,000 necessary to carry a single pound of basswood nectar), those bees must have made forty trips. On the same basis of calculation, a colony of equal strength that brought in 5 lbs. would make one-fourth as many trips, or an even ten. This would leave for each trip one hour for ten hours; or, in the case of 20 lbs. a day, twenty minutes.

Both Profs. Gillette and Lazenby, the former of the Colo. Experiment Station and the latter of the Ohio Experiment Station, conducted a series of experiments which very closely approximate figures of Prof. Coons, so that we are sure that they are correct.

*** We had one colony that brought in over 43 lbs. in three days; and Doolittle 66 lbs. in the same time from basswood.**

WHITEWOOD (*Liriodendron Tulipifera*). This is often called the tulip-tree, I suppose from its tulip-shaped flowers.

After writing the foregoing, I concluded I did not know very much about the whitewood, especially the blossoms. So I traveled off into the woods. At length I found a tree, but there were only buds to be seen, not blossoms. It must be too early in the season; but, hark! whence come those sounds of humming-birds and humming bees? Whence, too, comes that rare and exquisite perfume? I looked higher, and, away in the misty top of the tree I thought I discerned, by the light of the setting sun, multitudes of bees flitting about. Oh that I were just up there! I looked at the rough trunk of the tree, and meditated that I was a boy no longer, but a man of 40, or would be in a few months more. I might get up to that first limb: after a good deal of kicking and puffing, I got up there. The next was a harder pull yet; but soon the limbs were thicker, and finally I began to crawl upward with about as much ease as our year-and-a-half-old baby goes up stairs, whenever she can elude maternal vigilance. Up, up, I went, until, on looking down, I really began to wonder what that blue-eyed baby and her mamma would do, should my clumsy boots slip, or a dead limb break unexpectedly. Now I was in the very summit of the tree, and, oh what a wonderful beauty I saw in those tulip-shaped blossoms that peeped from the glossy-green foliage all about me! No wonder there was a humming. Bumble-bees, gaudy-colored wasps, yellow Italians, and last, but not least, beautifully plumaged humming-birds, were all rejoicing in a field of sweets. Every now and then one of the latter paused before my very face, and, as he swung pendulously in mid air, winked his bright little eyes, as much as to say, "Why, what on earth can *you* be doing away up here in our domain?"

I picked off the great orange-colored, mottled blossoms, and looked for the honey.[240] I presume it was the wrong time of day to expect much; but the inside of those large petals seemed to be distilling a dark kind of dew that the birds and insects were licking off. It tasted to me more like molasses than honey. In the next cut our engraver has tried to show you what I saw in the tree-top.

As the sun had gone down, I commenced in a rather undignified way to follow suit, and, after resting a little, limped home. Although I was stiff and sore, I carried an armful of whitewood blossoms to surprise

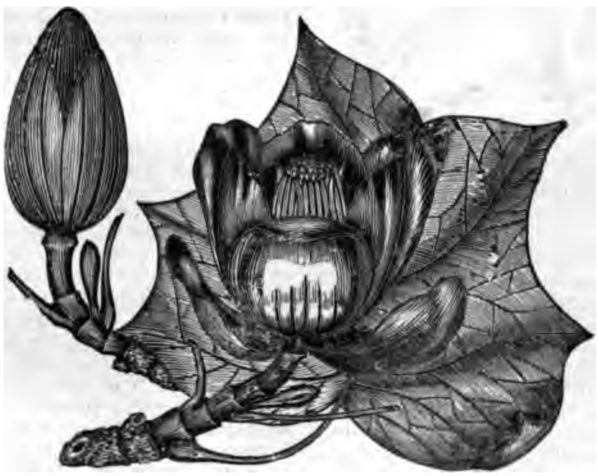
the good folks who, probably, had never dreamed of the beauties to be seen only in the tree-tops.

Our friends in the South have a great deal to say about what they call "poplar honey;" and, if I am correct, the poplar is the same tree which we call whitewood. It blossoms with them in April and May. I know what time it blossoms here, for I thought about its being the 27th of May, when sliding down out of that tree. Shortly after, I received some bees from G. W. Gates, of Bartlett, Tenn. The combs were filled and bulged out with a dark honey, such as I have described, and the bees had built fins of snow-white comb on the cover of their shipping-box. From this I infer the honey must be yielded in great abundance in those localities. I have seen it stated that the large flowers sometimes yield a spoonful of honey each. As the tree is often used for ornament, I make the following extract from *Fuller's Forest-Tree Culturist:*

LIRIODENDRON TULIPIFERA *(Tulip-tree, Whitewood).*

Leaves smooth, on slender petioles, partially three-lobed, the middle one appearing as though cut off; flowers about two inches broad, bell-shaped, greenish yellow, marked with orange; seeds winged, in a large cone-shape cluster, which falls apart in autumn. The figure shows a single seed as it appears when separated from the mass. It blooms in May and June, and the seeds ripen in late summer or early autumn, and should be sown as soon as ripe, in good, moderately dry soil. They may remain in the seed-bed two years, if desirable, but should receive a slight protection the first winter; tree of large size, sometimes 130 feet high, with a very straight stem; wood light color, greenish white, soft and light, not hard enough to

receive a polish. It is much used in cabinet work, and for making panels for carriages, and for any inside work where toughness or a hard surface is not required. There is perhaps no native wood that will shrink more in seasoning than whitewood, for it not only shrinks sidewise, but endwise as well; but when once thoroughly seasoned, it remains fixed, and does not warp or twist like many of the hard and tough kinds of wood. There is also much difference in character of the wood coming from different sections of the country, and mechanics who are conversant with the various kinds and localities will readily tell whether specimens came from the West or East. The latter is of a light greenish color, grain not so smooth and soft, and sometimes rather tough. The wood is but little used, except for the purposes mentioned above, consequently it is only large trees that will be of much value. It is one of the most beautiful ornamental trees we possess, growing in a conical form, and producing an abundance of its beautiful tulip-shaped flowers in spring. The roots are soft and sponge-like, and it requires great care in removing to insure success.



LEAF, BUD, AND BLOSSOM OF THE WHITEWOOD, OR TULIP-TREE.

The question is often asked, "Is whitewood good for bee-hives?" It may do for sections and brood-frames, but it is very unsatisfactory for hives, for the reasons given in this extract.

WILLOW. As I have had little or no experience with this shrub, and as it does yield honey and pollen in some localities, I can do no better than to copy an article with the engravings, from the pen of G. M. Doolittle, as given in *Gleanings in Bee Culture*, p. 486, Vol. XVII.:

Among the pollen-bearers we have several kinds of what is known here as "pussy willow" *(Salix)* which put out their blossoms quite irregularly. Some are a month earlier than others, and some of the buds on the same bush are ten days later than others. The kinds which seem to attract the bees

most are the black willow, upon which the kilmarnock is budded, and those which produce a long cone-like flower similar to the black willow, the accompanying cut giving a fair representation of the latter, a week or so after it is through blossoming and has partially gone to seed. From these two kinds the bees obtain large quantities of pollen, but, so far as I can ascertain, no honey. As this pollen comes the first of any which we have which amounts to any thing, I esteem it of great value to the bees. Skunk-cabbage gives pollen a little earlier, but we

PUSSY WILLOW.

do not have enough of it to amount to much, compared with what these willows give. The flowers are of a rich orange color, and consist of a center out of which spring hundreds of little thread-like filaments, upon which the pollen is supported. It is very interesting to see the bees work on these flowers, as you can see their motions so plainly, for the tree or bush does not grow so high but that some of the lower limbs are about on a level with the eye. Here is a peculiarity of the willows, for all those in this section which give pollen grow in a bush form, while all of those which yield honey grow to be quite large trees, often reaching six feet in circumference.

GOLDEN WILLOW.

The pussy willow naturally grows on low swampy ground; but with a little culture to start, it will grow readily on dry ground. They grow readily from cuttings put in the ground in early spring, as do all of the willow tribe. The above are often set down as "honey-plants;" but according to Quinby and my own observation, they produce no honey. As they grow very plentifully about here, I have had much observation regarding them. To be sure, the bee is continually poking its proboscis into the blossoms, the same as they do when sucking for honey; but after killing many bees and dissecting them, I have been unable to find the least bit of honey in their sacs. This way, if used when the bees are at work on any of the honey-bearing flowers, never fails to reveal honey accumulating in their sacs.

HONEY-PRODUCERS.

Of these we have three kinds—the golden willow, the white willow, and the weeping willow, and they are of value as honey-producers in the order named, although the weeping willow blossoms about three days earlier than the others. This would make it of more value to the bees, even did it not yield honey quite so profusely, if there were enough trees to keep the bees busy; but as there are very few trees of this kind about here there is not enough to make any account of. None of the three willows mentioned here give any pollen that I ever could discover, for none of the bees at work on these trees ever have any pollen in their pollen-baskets. If there is any species of willow which yields both honey and pollen, I am not acquainted with it. The flowers are similar to those which grow on the birch and poplar, being of a long tag-like shape, as large as a slate pencil, and from one to two inches long. Those on the golden willow are the longest, and yield honey abundantly.

The engraving presented herewith so nearly represents the golden willow that any one should know it in connection with its yellow bark, which distinguishes it from the other kinds of honey-yielding willow, as all of the rest, so far as I know, have a light-green bark. When these willows are in bloom, and the weather is warm, the bees rush out of their hives at early dawn, and work on it all day long as eagerly as they do on clover or basswood. The blossoms often secrete honey so profusely that it can be seen glistening in the morning sun, by holding the blossom between you and that orb, while the trees resound with that dull busy hum, so often heard when the bees are getting honey, from morning till night. As this is the very first honey of the season, I consider it of the greatest of value to the bees, for the brood is now crowded forward with great "vim," which brood gives us the bees which work on the white clover, while the honey often helps very greatly in piecing out the depleted stores of the hive. These willows blossom a little in advance of the hard maple, and hold out as long as they do; and from the fact that, when I kill a bee at work on these willows I always find honey in its sac, while when I do the same with a bee which is at work on the maple I never find any honey, I have been led to think that perhaps those reporting honey might be mistaken, and that the honey really came from the willows. Again, maple blossoms only every other year with us, while the willows never fail; and I have noticed for years that I got fully as much honey in the years when the maples did not bloom as I did the years when they did. From the few trees along a small creek near here, my bees frequently make a gain of from six to ten pounds of honey while the willows are in bloom, and one season they made a gain of 15 pounds. This present spring some of my

best colonies gained 8 pounds, while on apple-bloom they did not get more than a living, with apple-orchards white with bloom all about. The honey from the willow is quite similar to that from the apple-bloom, and of a nice aromatic flavor. As the willows gave the first pollen, and also the first honey each season, it will be seen what a great help they are to all who have them in profusion near their bees. The only drawback there is, is in the weather often being unfavorable, for I do not think that more than one year in three gives good weather all through the time the willows are in blossom. So far as I know, honey and pollen are always present in the respective kinds when they are in bloom; but the trouble is, that it is so cold, rainy, cloudy, or windy for the bees to get to the trees so much of the time, at this season of the year, that honey or pollen from this source is not at all certain.

Borodino, N. Y. G. M. DOOLITTLE.

WILLOW-HERB. Often called fireweed, sometimes Indian pink, and rose bay. The scientific name is *Epilobium angustifolium*. Its growth is confined to the lumbering regions of Northern Wisconsin, Minnesota, Michigan, Canada, and Maine, over those areas that have been burned over by forest fires, and hence the name "fireweed." After the fires it seems to spring up spontaneously, monopolizing the soil to itself.

It is a handsome plant having a beautiful pink bloom; usually has only a single stalk, and grows from two to six feet high. The flowers are of a dark pink, and arranged in clusters around the stalk. As the season advances, the first bloom goes to seed; and as the stalk extends upward, more blossoms appear, so the plant keeps in bloom from July till frost. Thus appear on each stalk buds, blossoms, and seed-pods at one and the same time.

WILLOW-HERB AND ITS HOME (FROM THE BEE-KEEPERS' REVIEW).

Willow-herb, or fireweed, yields quantities of white honey. Some of it is so light-colored as to be actually as clear and limpid as water, and the flavor is simply su-

perb—at least so I thought after eating some at one of the Michigan conventions which I attended at Grand Rapids. Mr. Hutchinson styles it the whitest and sweetest honey he ever tasted, and says the flavor, while not very pronounced, is suggestive of spiciness. The quality of the honey, its unfailing supply from year to year, that it follows right after clover and basswood, and blooms from then on till frost, make it one of the most valuable honey-plants known. Unfortunately its growth is confined almost exclusively to the regions where forest fires occur. But fortunately those bee-keepers who are situated in its vicinity are enabled to secure immense crops of fine white honey. Another remarkable feature of the plant is, it yields every year—at least so continuously that a failure has scarcely been known, even by the oldest inhabitants in the vicinity where it grows.

Mr. Hutchinson estimates there are thousands of acres in Northern Michigan where this plant grows, with no bees to gather its delicious nectar. But this condition certainly can not exist long; for when one can produce anywhere from 100 to 125 pounds of comb honey per colony, the unoccupied fields will soon be covered by bee-keepers, after the manner of the rush of the gold-seekers to the Klondike.

For the fine illustration accompanying this, I am indebted to the editor of the *Bee-keepers' Review*. The picture was taken when the willow-herb was out in all its glory. In the background appear the straight black shafts of dead pine-trees that stand out alone as the only survivals of their class from the fires. While we can not but deplore the loss of the pines that furnish the only timber fit to make hives of, we can rejoice that they have been displaced by so valuable a honey-plant.

All attempts to grow this plant out of its native habitats have proven to be failures.

WINTERING. If the reader has been over faithfully what I have written in the preceding pages he is nearly ready to sum up the matter of wintering with me, with but few additional remarks. Under the head of ABSCONDING SWARMS, in the opening of the book, he is cautioned against dividing, and trying to winter weak colonies. See *Absconding in Early Spring*, under the head mentioned. In regard to keeping bees warm through the winter with ARTIFICIAL HEAT, see that head. In regard to the effect of different kinds of food or stores on the welfare of bees during winter, see DYSENTERY, FEEDING AND FEEDERS, CANDY FOR BEES. In regard to fixing the size of the entrances, see ENTRANCES TO HIVES, VENTILATION, and PROPOLIS. For a consideration of the different sizes and shapes of frames for wintering, see HIVES. For the consideration of double-walled or chaff hives, see HIVES.

WHEN TO COMMENCE PREPARING BEES FOR WINTER.

If either bees or stores are lacking they should be supplied during warm weather, so that all may be quiet and ready for the winter doze which nature intends them to take, long enough before winter weather has actually set in.[623]

I would not undertake to winter any colony unless it would cover well as many as 4 L. frames.

If we have the four combs average about five pounds each, we shall be on the safe side. If our colony is heavy enough to cover 6 combs, clear out to the ends, during a cool night, they will perhaps need 6 combs filled so as to average 5 lbs. each.* When we get the bees and the stores, with the chaff cushions on each side, they are all ready to winter, by simply putting a thick chaff cushion over them. This arrangement is not as good as a regular chaff hive, but it has answered for several seasons past, quite well. If the winter is very severe, a colony that would cover densely 5 or 6 combs would be much safer than a smaller one. The main points are, a brood-apartment closely packed with bees, and plenty of good sealed stores. With these two conditions alone, the bees will generally winter through, even in a hive made of inch boards, but it will be at the sacrifice of many bees that would otherwise have lived. If the bees are not enough to fill the hive, reduce the size of the apartment until they do fill it. This is usually done by a division-board. If the walls of this wintering apartment are made of thin wood, the bees will then keep the thin walls of the hive, as well as themselves, warm all winter, and we shall then avoid the loss that often ensues by bees continually freezing in the outside combs. This is the purpose of the chaff hive.

SNOW AS A WINTER PROTECTION.

In colder climates there is a great amount of snow, and this affords the very best kind of protection to the hive. The deeper it

*Those figures are based on outdoor wintering. For indoor they may be cut down about one-third.

is, the better. Even if it is waist deep, as shown in the illustration, it will do no harm. It is well known that snow protects vegetation, and keeps the ground from freezing, providing, of course, it was not frozen before the snow fell. In a similar way it protects a hive of bees; and if we could be *sure* of having deep snow all winter, single-walled hives would do as well, perhaps, as the double-walled. But, unfortunately, it is liable to melt away during a winter's thaw, and this may be followed by cold zero weather without snow. It behooves us, therefore, to have the hives double-walled and packed, so as to be ready for any emergency. But it may be said that, the more snow we have, the better bees will winter, and the less stores will be consumed.

A. E. MANUM'S HOME APIARY IN WINTER.

The question is often asked whether, under such deep snow, there is not danger of bees smothering. I should say not, unless the snow melts and freezes again so as to close up the entrance with ice. But this is very rare. Some bee-keepers take the pains to dig away the snow from around the entrance, but this is usually not necessary. The bees will winter fully as well, if not better, with the snow all around in front of the hives; for it is well known that loose snow contains a large amount of air, and that air will percolate all through it. If, however, snow is melted enough to be mushy, and if then it begins to freeze, it would be better to look carefully to all entrances.

VENTILATION, AND ITS RELATION TO FROST AND DAMPNESS.

I think the subjects of chaff packing and ventilation are not clearly understood. Bees become damp because the walls of the hive are so cold as to condense the moisture from their breath. If these walls did not become cold, no moisture would condense on them, and no dampness would accumulate in the hives. On a cold winter night, frost sometimes accumulates on our windows until it may be ¼ inch in thickness. The amount of ice depends on the difference in the temperatures of the air on the two sides of the glass. If the air outside should be below zero, while that inside is 70 or 80, and at the same time is fully charged with moisture from the kitchen, perhaps, as is the case frequently on washing-days, or even from the breath of many persons, the accumulation of ice on the glass will be very rapid. If the room is kept warmed up, the ice will melt, and the water will run down until the floor becomes quite wet. While running a small engine one winter, in a room having large glass windows, the water accumulated so rapidly on the glass that we had to attach a tin trough to the window-sill to catch it, and in a little time we caught a pailful from the end of the spout. The cause is this: Warm air takes up and holds in solution a large

quantity of water. This water is, of course, invisible, and we have scarcely any means of detecting it so long as the temperature of the air is unchanged by coming in contact with colder substances, or currents of air of a lower temperature. If the walls of the room are kept warm, there will be no perceptible dampness. Let them be chilled, as in the case of the window-pane, however, and we shall have the warm air dropping its water the very minute it comes in contact with the cold surface, in exactly the same way that dew is deposited on a hot summer day, on the outside of a pitcher containing cold water. The process with the window goes on, because currents of air are started both on the outside and inside of the glass, by the heat that passes through the glass. To make this plain, let A, in the cut below, represent the pane of glass.

The arrows represent the course of the currents of air. The greater the difference in temperature between the outside and inside, the more active are these currents, and the greater is the deposition of dew or ice on the surface of the glass on the inside.

HOW BEE-HIVES BECOME DAMP.

In the warm room you will see that the air is chilled as it strikes the window, and then falls because it is heavier; this gives place to more warm air, and keeps up the circulation. On the outside, the cold air next the window becomes warmed, and rises on account of being lighter, and this keeps up a similar action on the *inside*, the direction of the currents being reversed. When the temperature of the air is lowered it discharges its moisture. When the temperature is increased, the capacity of the air for holding moisture is increased also. Thus you see how the water from the air is condensed on the windows, and goes down into the pail. The air in the room would soon lose its moisture, were not more supplied from the breathing of living persons, or from the kettles on the stove, from damp air rising from the cellar, or from something of that kind. I need hardly state that the same operation goes on in the bee-hive, especially if the walls are thin, and the hive at all tight. If the top of the hive is a thin honey-board, with cold air above and warm air below, ice will be sure to collect over the cluster, and when it melts will dampen the bees. The sides of the hive will be covered with frost, and perhaps a heavy coat of ice, by the circulation of currents of air as I have explained. Now let us go back to the window, and place one of the chaff cushions I have advised for wintering, close against the window-glass, on the outside. This will stop the outside circulation, and the light of glass will soon become warmed through to such an extent that no ice, or dew either, will condense upon it. To make a further protection, suppose we put glass or boards on the outside of the cushion, or, in fact, make two walls, with chaff between them as in the chaff hive. A good colony of bees would warm up the thin walls next to them, sufficiently to prevent either frost or moisture from accumulating on them at all. Now, if the walls all around the bees are thus protected with chaff cushions, they can not well get frosty on the outside, and thus accumulate either moisture or dampness on the inside. As a proof of this I have wintered a colony nicely, with a covering of enameled cloth over them, that was almost absolutely impervious to air. To be sure, a thick chaff cushion was over this enameled cloth, or it would have been wet very quickly with the condensed moisture; in fact, several colonies became quite wet during frosty nights in the fall, before the chaff cushions were put on. Now, if the bees are to keep these walls about them so warm that moisture can not condense on them, the walls must be close to the cluster of bees, and certainly the material for them should be a non-conductor of heat, and they should be so thin that they will readily warm through. Although it may not be absolutely necessary that the walls and covering should be of some porous material, which will absorb any chance moisture from the breath of the bees, it will perhaps be better that they should be so, and many experiments seem to indicate that straw or chaff is the best material for this purpose. For the reasons I have named, the old-fashioned straw hive, which has for ages been emblematical of the honey-bee, seems to be very nearly what is wanted to protect them in the way they seem to demand. The straw next to them is warm, and therefore proof against condensation; it is thin, and hence easily warmed; is a non-conductor of heat; and while it may permit the air to pass through the porous walls slowly, it does not admit of a draft of cold air through the hive, as does a badly made wooden hive, or one that has cracks or fissures here and there. See STRAW SKEP.

HOW TO WINTER BEES OUTDOORS PACKED IN DOUBLE-WALLED HIVES.

One of the requisites, though not necessarily an essential, is early preparation. If I had every thing to my liking I would have all colonies prepared for winter by the first of October for our latitude, 41. For a little further north, about the middle or first of September. A good many bee-keepers begin preparations as soon as the honey season is over; that is, in the middle of August. This preparation means early feeding to induce brood-rearing, so that the colonies may begin the rigors of winter with a large force of bees, the majority of which are probably young, and not old worn-out fellows that will die in a month or so. Many times circumstances are such that we are not able to begin preparations before November. We have fed our bees as late as the first of November, and packed them, and then had them winter successfully. But because we have done so one year, two years, or more, successfully, is no reason why we would urge beginners and others to put it off until that time. For particulars in regard to feeding, you are referred to that heading in the fore part of this work.

TWO-STORY DOUBLE-WALLED OR CHAFF HIVE.

HOW MANY POUNDS OF STORES FOR OUTDOOR WINTERING?

Before the final packing, I would see that every colony had from 20 to 25 lbs. of sealed stores, the same distributed on from four to six combs. Some colonies are strong enough to cover eight, but usually almost all colonies can be contracted to six L. frames. As a general rule, give the bees as many combs of sealed stores as they will cover by the time we have frosty nights, and the days are just a little too cool for bees to fly very much—at least, before the latter part of the day.

Put in a division-board, as described under that head elsewhere, to take up the space of the combs taken out; and this division-board should be put in before feeding has been entirely finished, and should be, if possible, put on the north side of the brood.

SIZE OF ENTRANCE.

This should not be more than $\frac{3}{8} \times 8$ inches for strong colonies and shorter for weaker ones. All summer entrances that are $\frac{3}{8} \times 12$ inches should be contracted to the size indicated.

SHALL WE SPREAD THE BROOD-NEST?

A good many of those who winter successfully, urge that, before the final packing, the brood-frames should be spread from the regular breeding distance, that is, $1\frac{3}{8}$ or $1\frac{1}{2}$ inches from center to center, to about $1\frac{3}{4}$. We formerly spread our brood-frames; but in later years, after trying both ways we can see no difference in result. We now leave the frames spaced just as they were in summer.

WHAT TO COVER FRAMES WITH.

Some authorities prefer and recommend a thin board just large enough to cover the top of the hive, which, of course, the bees will seal down hermetically tight with propolis. Over this thin board is placed a cushion or shallow tray containing chaff, leaves, planer-shavings, or other packing material. But other authorities, and perhaps the majority, prefer absorbents. They would place a Hill device on top of the brood-frames; or, if they do not have this, two or three little blocks or corncobs—any thing to hold the absorbing material far enough above the brood-frames to leave a clustering-place. Over all is placed a sheet of burlap, and over this again a chaff cushion. This will absorb the moisture, or "sweat," as some call it, of the bees, leaving the brood-nest dry. But along in the spring this packing material often becomes so moist as really to be a detriment; and that is why the sealed-cover advocates object to absorbents, for they would have the top of the brood-nest sealed tight.

We have wintered very successfully both ways; and after trying the two plans side by side we really can not determine which is the better; although, all things considered, it would seem as if the sealed top had the advantage; for then the packing material above the brood-nest is always kept dry; and the moisture, if any, is compelled to condense and run out of the entrance.

With the modern chaff hives it is not practical to use cushions, for it is difficult to

place something of this sort under a telescopic cover, and yet have it fit down over the brood-nest snug and warm. A tray about five or six inches deep, and just large enough to go inside of a telescopic cover, is made out of ⅜-inch lumber. On the bottom is nailed a piece of burlap, or any cheap cloth. This tray is now filled with leaves or

packing material of any sort, when it is ready to be put on the hive, to be used either with a sealed cover or on the absorbing plan as already described. The illustration shows

HILL DEVICE FOR COVERING THE FRAMES IN WINTER.

the modern double-walled hive with the tray in position under the telescopic cover. Under the tray is the Hill device on the absorbent plan.

BEST KINDS OF PACKING MATERIAL.

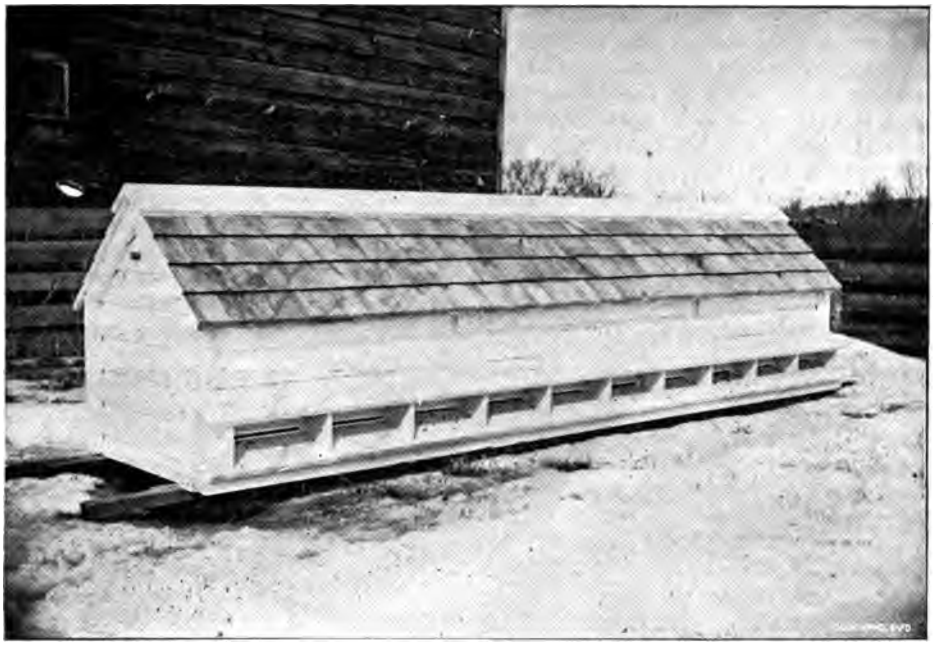
Wheat or oat chaff was formerly recommended as being the best material to use. While these are certainly good, and perhaps the most available of any material to the average farmer, we now know that other packings give quite as good results; but as between wheat or oat chaff the former has a little the preference. The next material that is used very largely is planer-shavings, such as come from the ordinary planing-mill; and I do not know but I would just as soon have them as any kind of chaff. Another packing that has given most excellent results is dry leaves of forest trees. These may be gathered up and stored in a dry place, and then when the bees are packed the leaves are ready for use. But when dry leaves are used, there should be more of them, because they do not afford quite so dense a packing. Sawdust from ordinary sawmills is another material that is sometimes used; but if any thing it is a little too dense, and the cushions made of it are very heavy. Still, I would use it if nothing else were available.

WHAT TO DO WHEN COLONIES RUN SHORT OF STORES.

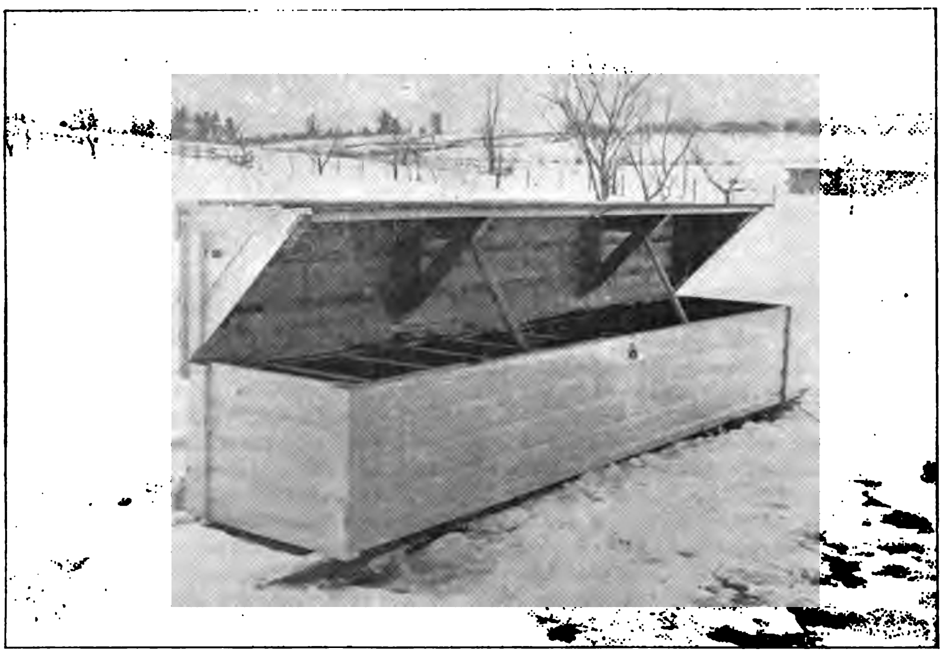
We will suppose that, from some cause or other, some colony has run short of stores. You ask, "How are we to know what ones are short?" Sometimes in filling orders for bees and queens, late in the fall, we are obliged to keep our colonies running till very near November, and we have to do our feeding on short notice. When it comes on cold weather, and we are unable to feed any more, we put a little stone on the cover, or some mark to indicate that this or that colony *may* run short of stores. On the first warm sunny day in mid-winter—when it is warm enough so the bees can fly—we go through the whole apiary. We simply lift the tray, pull back the burlap, and peer down into the cluster. If they appear quiet, and there seems to be an abundance of sealed stores, we close the hive up immediately, and so on until we come either to a weak colony that needs uniting with another weak one, or a strong stock that has consumed so many stores in brood-rearing that they need feeding. As the weather may turn cold suddenly, we pick out of the honey-house a good comb of sealed honey, and lay it horizontally above the frames, with a Hill device under it, so as to keep it from closing up the passageway over the frames. We cover the whole with a burlap sheet; replace the cushion, and let them go until the next warm day, when we again make an examination; and if a little short, we turn the comb over and give them the benefit of the other side. If we do not happen to have the sealed combs, we give them a cake of maple sugar or candy (see CANDY), on top of the brood-frames, and all will go well;[245] but, as I stated before, it should not be necessary to feed colonies during mid-winter. They should have enough stores, say 20 or 25 lbs., to last them from October until the first or middle of May.

WINTERING BEES IN TENEMENT HIVES.

Some bee-keepers, prominently among whom may be named E. and N. E. France, of Wisconsin, and W. L. Coggshall, of New York, winter their bees in double-walled tenement hives. As the name indicates, it



ORTON TENEMENT HIVE CLOSED—FRONT VIEW.



ORTON TENEMENT HIVE OPEN—REAR VIEW.

consists of two or more hives all under one roof. Of course, one double-walled hive large enough for four or five colonies can be made cheaper than four or five single hives, and this is one factor in their favor. Another is, that one or more colonies will conserve the heat. But the objection to these big hives is that they are large and unwieldy, and not suitable for out-apiary work on account of the difficulty of transportation. It is for this reason that so few bee-keepers, comparatively, use tenement hives.

The Orton tenement, the one shown in the accompanying engravings, is built to take in ten colonies. It is double-walled, and made of ordinary drop siding. The roof is a simple plain gable, shingled, and hinged so as to tilt back for the purpose of getting at any particular colony, and in this connection it goes without saying, that any cover so large as this would have to be hinged, as it would be practically out of the question for one person to lift such a cover off and put it on again. The whole material for making the Orton hive complete costs about $5.00; and if one is handy with tools he can make a pretty cheap winter hive for ten colonies. The general shape of the Orton tenement is such that by putting an extra reach in the wagon, after taking off the box, it can be set on wheels and hauled to an outyard very easily; so it is less objectionable than some others that are too wide to go between the standards of an ordinary wagon.

One defect in this Orton hive with roof hinged as shown is that, when it is being worked, the operator must necessarily stand *in front* of the entrances. This will at times irritate the bees to some extent, as well as cause them to enter the wrong entrance, and possibly kill a valuable queen. But, happily, the defect can be easily remedied by hinging the cover on the other side, thus bringing the entrances opposite the operator.

THE E. FRANCE TENEMENT HIVE.

THE E. FRANCE TENEMENT HIVE.

This was devised by E. France, and is what he calls his "quadruple" hive. He and his son have used them for a good many years, and still use them. They are used at their outyards, and left in position year after year, both winter and summer. If the four colonies cluster toward the center of the hive, they will thus be able to conserve the animal heat, and in this respect a tenement hive has an advantage over an ordinary double-walled chaff hive designed to hold one colony.

While tenement hives are cheaper in first

cost, and have some very decided advantages, yet a very great majority of bee-keepers either winter in one-colony chaff hives or else put their bees in the cellar.

ADVANTAGES AND DISADVANTAGES OF OUTDOOR WINTERING.

(1) Outdoor colonies *can be* prepared in October, and left without examination until the first part of May, if prepared as they should be, providing one does not fill orders for bees aud queens in the fall. (2) If the bees, from a long spell of cold, have contracted dysentery, the first warm day gives them an opportunity for a cleansing flight.[346] (3) Beginners and others who may not possess the requisite skill for indoor wintering will ordinarily be successful with the outdoor plan. (4) The colonies of the home apiary can remain year after year, and winter upon the same stands; and where one can afford it, an out-apiary of chaff hives does away with hauling bees in the spring and fall. (5) The chaff hive is always preferred, even for a cold day in late spring or early summer; whereas single-walled hives sometimes give rather meager protection after setting out. The outdoor colonies in chaff hives have been used to the rigors of winter; but the indoor colonies, being set out about the middle of April or first of May, many times receive a setback that takes them all summer to get over, by an unexpected cold wave.

The disadvantages are: (1) The first cost of hives. Every beginner, not knowing whether he can make the business successful or not, wishes to start out as economically as possible, and accordingly is in a quandary as to whether he shall go to a greater expense and purchase chaff hives, or be more moderate and purchase the single-walled hives. (2) It seems to be generally agreed, that colonies indoors consume less stores than those out—just how much less, nobody seems to know exactly; some think half the stores or over; others, a third. The latter estimate is probably nearer correct. (3) Chaff hives, as I have already stated, are rather heavy and unwieldy; and in swarming, too, it becomes necessary many times

THE W. L. COGGSHALL TENEMENT HIVE.

to change the location of the hives. One person can hardly handle a chaff hive without the aid of a wheelbarrow, while he can, with comparative ease, carry a single-walled hive wherever he pleases. It sometimes happens that a bee-keeper discovers that a certain district is yielding for a time considerable nectar, while at home his bees are doing nothing. He desires to carry a large number of colonies to the place in question as soon as possible, to catch the flow. If he has chaff hives, he can not very well carry more than five or six at a time in a wagon; whereas he can load twenty-five or thirty single-walled hives; and when the flow has ceased, he can take them to another place. In these days of out-apiaries, chaff hives have the very disagreeable feature of being non-portable, or practically so. *Experienced* bee-keepers, in a cellar properly constructed, will winter in the cellar with less loss of bees and less consumption of stores than outdoors; and this brings us to the subject of

WINTERING IN CELLARS OR SPECIAL REPOSITORIES.

Years ago winter repositories were unsatisfactory to say the least. Within the last few years, however, they have given better results. Instead of bee-keepers losing almost every winter, and having troubles from dysentery, bee-journals and bee-conventions have so disseminated information that indoor repositories are now wintering bees as successfully — certainly with less consumption of stores—than double-walled hives outdoors. Among the very first who were able to announce to the bee-keeping world that they wintered *every* year without loss was H. R. Boardman, of E. Townsend, O. At the time it seemed a little remarkable. Very soon after, others began to report success. It will be in order, then, to inquire what are the elements that contribute to successful wintering indoors, and at the same time glance briefly at some of the causes that contributed to failure years ago.

One of the first and most important causes was taking the bees out too early. As a general thing, the heavy losses came after setting the hives out, which was usually done some time in March; and March is a month in our locality that may be any thing from a bright, almost summer day, to a boisterous zero weather. Bees that have wintered successfully, and have been set out too early, are pretty apt to succumb before actual warm weather in May has set in. The reason bees were set out early, was because bee-keepers were unable to keep them quiet in the cellar; and if they seemed disposed to dysentery, the only thing to do was to set them out. The problem, then, remained to find some means to keep them quiet until the middle of April or to the first of May. It is generally agreed that there are three or four essentials to accomplish this end. First, a temperature of about 45, and not varying very considerably either way throughout the winter; second, plenty of bottom ventilation, no top ventilation for the hives; third, though not nearly so important as the others, sealed stores; fourth, a cellar comparatively dry. A few, and a very few, claim that they can winter successfully in a cellar reeking with dampness if only the food is right;[247] but a dry place should be secured if possible. Fifth, pure air in the cellar. To secure this it is advisable to open the cellar doors or windows at night if the weather is warm or muggy outside, and, before daylight, close them again. The bees will become quite uneasy, and fly out on the cellar bottom unless the air is kept reasonably fresh. When our bees become restless we can quiet them, as a rule, by opening the doors at night, and letting the air blow through the cellar. But don't ventilate if the temperature during the night goes down to 10 above zero or below.

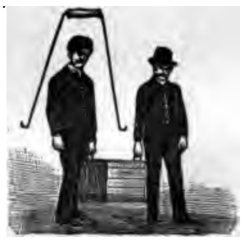
Having outlined briefly some of the essentials to indoor wintering, I will now proceed more in detail. As with outdoor wintering, early feeding is important. It will not be necessary to give the bees as large an amount of stores. Ten or fifteen pounds will answer very well; though, if convenient, I should prefer to let them have more. If the winter should be an open one,[248] some of the stronger colonies will rear brood during spring quite heavily, and consume all or nearly all their stores.

WHEN TO PUT INTO THE CELLAR.

In November, in the latitude of 40 or 41, the bees should be prepared to be set into the cellar at a moment's notice. The covers should be sealed down with propolis, to make the top of the hive air-tight. It is not necessary that there be a Hill device or any thing else over the frames, to give a passageway — simply the cover over the brood-nest is quite sufficient.[249] Some few bee-keepers remove it and leave on an enamel cloth or quilt. If the cloth or quilt is sealed down tight, it will answer, perhaps, as well. But for reasons presently to be given, I would leave the cover on. Well, along

about the 25th of November, in our locality, we put our bees into the cellar, the time being varied, of course, according to the peculiarity of the season. Whenever it turns cold and begins to snow, and the prospects seem pretty good for a continuance, we open up our cellar and proceed to carry them in.[250–623] Before doing so, however, with a screwdriver or cold-chisel we go around to each hive, puff a little smoke in at the entrance, and pry the body loose from the bottom-board, as it will always be stuck down with propolis. This had better be done a day in advance, however, as it sometimes disturbs the bees, and it will be hours before they will quiet down. With an assistant and a couple of hive-carriers we proceed to carry the bees into the cellar.

It is to be observed that our hive-carriers are simply a couple of lengths of wire bent



MANNER OF CARRYING BEES INTO THE CELLAR WITH HIVE-CARRIERS.

in the shape of a letter V, an ordinary wooden-pail handle being slipped through to the middle of the wire. Both ends are bent down in the shape shown in the cut in the enlarged view. The ends are then bent in the form of a hook, and sharpened so as to catch on the bottom-board.

MILLER'S ROPE CARRIER.

Dr. Miller uses a rope as shown in the accompanying cut. Of course, the rope can be used only when the hives are cleated at the ends.

Where hives are carried to any distance, and help is scarce, the yoke will be better. One man can carry two heavy hives quite

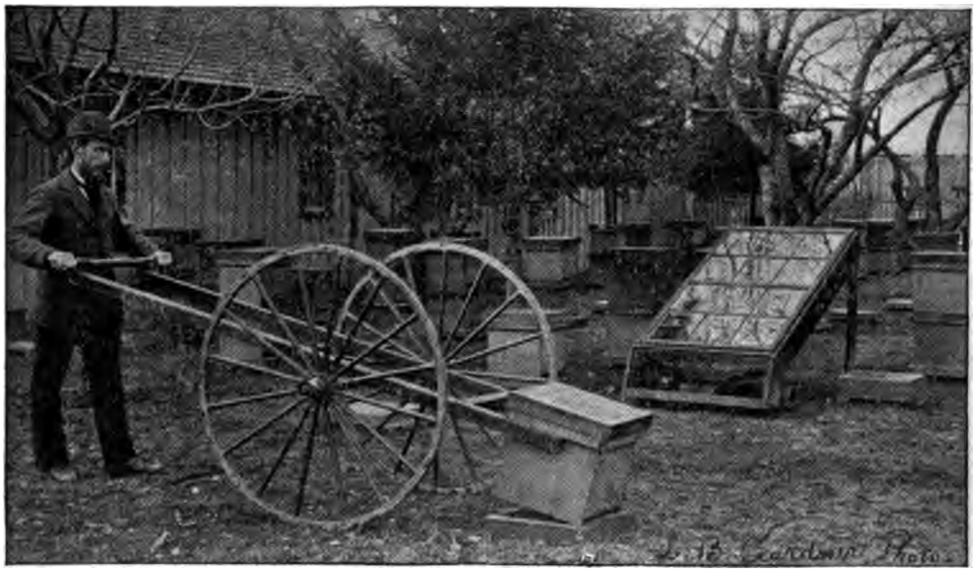
M'FARLAND'S NECKYOKE FOR CARRYING HIVES.

easily; ascend cellar-steps, and go through doors. The only objection is the rigging, and loading and unloading. For short distances we prefer the bails first illustrated. After one is once harnessed and loaded, the McFarland device is excellent.

INSIDE VIEW OF BOARDMAN'S REPOSITORY.

Having picked up the hive or hives we proceed to the cellar, and deposit the hive near the place where it is supposed to stay through the winter. Along on two sides of the cellar we have previously laid scantling,

say 14 or 15 inches apart, depending, of course, upon the length of the hive. We then pick the hive (just brought in) up by the hand-holes, lift it off its bottom, and lay it at one end on top of the scantling, and lay the bottom-board in one corner of the cellar. In like manner we bring in another colony, lift it off the bottom-board, and deposit it by the side of the other colony, leaving four inches between, and so on. We bring in other colonies until the scantlings are covered with hives four inches apart. We are now ready to commence another tier on top. The next hive that is brought in is piled on top of two others, in such a way that the



H. R. BOARDMAN'S HIVE-CART, AND METHOD OF CARRYING BEES INTO THE CELLAR.

bottom covers the space between two hives below, and so on we pile the rows of the hives. The next tier is followed up in the same manner, until we have three or more tiers high, each hive placed over the intervening space between the two below. When I visited H. R. Boardman in 1889 I took a photograph of his winter repository, an engraving of which I submit on previous page.

It will be noticed that his hives are piled up in the manner I have already described; namely, each hive covering the space between two below. The reason for this manner of piling is, convenience in the first place; and in the second place, to give ample bottom ventilation. You will now see an additional reason for leaving the cover on. If we removed the cover we could not pile the hives one upon the other so well.

Before I proceed further I wish to describe another method of carrying bees into repositories, where one person alone does the moving. The engraving below will fully explain itself.

In the engraving it is plain that it is simply an iron axle and a couple of cart-wheels. These are attached to a couple of 2 x 4 scantling, as shown above. The operator lifts the handles up, pushes them gently under the cleats of the hive, and bears down until the same is suspended. He then pushes it to the door of his winter repository, when he afterward stations it where he wants it. This same device can be attached to hives with hand-holes when necessary.

From this digression we will return to the bees in the cellar.

They have been piled up as illustrated and described, and provided with ample ventilation from the bottom. The bottom-boards, as they are brought in, are piled up in any place convenient in the cellar, and are left to remain until it is again necessary to remove them in the spring. A good many, however, leave their bottom-boards out on their summer stands the year round. The hives are carried in without the bottom-board, and piled up as described. But some have complained that the bees fly out

and bother. While we have succeeded perfectly in carrying them in without bottom-boards, yet we very much prefer to carry the bottom-boards in with the hives; first, because the bees are less liable to fly out and annoy; and, second, because the bottom-boards are protected from the action of the weather.

SHALL WE PUT THE HIVES BACK ON THE OLD STAND IN SPRING?

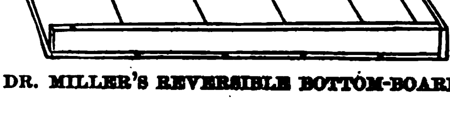
There is this advantage in leaving the bottom-board out: Mr. H. R. Boardman letters each row in his apiary, and numbers each hive, each body and bottom-board bearing the number and the letter of its respective position. In the spring, in carrying bees out he is able to deposit his hive right where it was the preceding fall. "C6," we will say, is to go directly to the C row, and on arrival it is replaced on bottom No. 6. Mr. Boardman does not attach very much importance to bees being put back upon their old stands; though if he can do it just as conveniently, he prefers doing so, because there will be some old bees that will go back to where they were the previous fall. All things considered I would put the hives back on the same stands from which they were taken, especially if the bees be given a mid-winter flight, as will be explained further on.

BOTTOM VENTILATION FOR THE HIVES, AND HOW TO SECURE IT.

One of the prime causes of unsuccessful wintering in repositories is in leaving on the bottom-boards as they are in summer. The bees have only just what ventilation they can get through the entrance, ⅜ inch wide. The majority if not all of those who winter successfully in the cellar leave the bottom-boards off entirely.

OTHER METHODS OF GIVING BOTTOM VENTILATION.

I've already given our general plan of wintering bees in the cellar. Perhaps it would now be well to give you some of the methods employed successfully by others. Capt. J. E. Hetherington, of Cherry Valley, N. Y., the most extensive bee-keeper in the world, owning some 3000 colonies, I believe has a square hole cut in the bottom-board of his hive. Dr. C. C. Miller uses a reversible bottom-board, as shown in the cut.



DR. MILLER'S REVERSIBLE BOTTOM-BOARD.

The drawing above will make the whole matter plain. By using one side of it he has simply a ⅜ space under the brood-frame for summer use. For winter use the bottom-board is reversed, and this gives him two inches, or thereabouts, under the brood-frames, with entrance two inches deep, and the full width of the hive. The doctor likes this bottom-board, and has had very good success with it. See ENTRANCES.

CELLARS VERSUS SPECIAL REPOSITORIES.

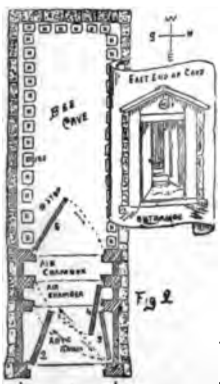
Cellars are more generally used than up-ground buildings. One reason is, that almost everybody has a cellar under his house. If the same can be darkened, and during warm days will not go much above 50 degrees, nor cool off much if any below 40,

FIG. 1.—OUTSIDE VIEW OF DOOLITTLE'S BEE-CELLAR.

is perfectly dry, and can be partitioned off from where vegetables are kept, we have a fair wintering-place.[252 627] But a good many may have only a damp cellar; or if they do not have that, it is so small that it can hardly be spared for the bees. Special up-ground or partially up-ground cellars are

then usually constructed. The accompanying engravings show the repository that Mr. Doolittle has used for a number of years with good success. It occupies a partial side hill. A fence is put in the rear so that snow will bank over the roof. Fig. 2 shows exactly the inside of the structure. It will be noticed that Mr. Doolittle has three doors. Two, I think, are sufficient. The ventilation at 6 gives what little ventilation is needed.[254] The following is a description, taken from the pen of Mr. Doolittle:

Fig. 1 represents the outside appearance of the cellar, as viewed from the southeast. The ground should rise gradually from the foreground up to the fence, the back end of the roof at the peak being lower than or as low as the ground opposite to it, on each side. The outer roof is hemlock boards battened. In Fig. 2, 1 represents the window in the gable end of the ante-room, so I can have a little light after I go in and shut the first door. In this ante-room (see Figs 2 and 3) I light my candle, have the sawdust to carry in to spread on the floor, etc. In Fig. 3, 4 is the upper drain, or water-course, to carry off all surplus water coming from the roof and elsewhere, it being made in a large scoop form by taking dirt out to go between the two roofs, as illustrated in Fig. 1. The fence is shown in the rear. This causes the snow to drift on the roof. In Fig. 3, 6 shows the ventilator at the back end of the cellar.



GROUND-PLAN OF BEE-CELLAR.

Fig. 2 represents the front view, also the ground-plan of the ante-room and doors. 1 is the casing that the outer door hangs on, and against which it shuts; 2 is the outer door which swings in and around against the south side of the ante-room; 3 is the first door toward entering the cellar; and in opening, it swings out and round the north side of the ante-room, finding the position when open as represented; 4 is the next door, two feet further in, which in opening also swings around against No. 3, as shown; 5 is the door entering the cellar; and in opening, it swings into the cellar around against the south wall, unless the cellar is full of bees, in which case a stop is so placed that it will not hit the hives.

In entering the cellar I first go into the ante-room and shut the door, as I have explained; then I open Nos. 3 and 4, and step into the last dead-air space, closing No. 4 after me, but allowing No. 3 to remain open. I now open No. 5 and quickly step into the cellar, closing 5 after me. Thus it will be seen that very little change of air can take place by my entering, especially when I say that all is covered overhead and on all sides with dirt, except the ante-room.

Fig. 3 represents the inside of the cellar. 1 represents the floor, or cellar-bottom. This is always quite dry, as there is a drain under the wall, and below the bottom all around, being 8 inches deep at the southwest corner, and 20 inches deep at the northeast corner, or outlet. 2 represents the south wall. The hives are put up along both walls and west end, putting one on top of the other ones four deep, as seen at 8; also by H, H, etc., in Fig. 2.

In Fig. 3, 3 is the inner roof, which is made by using 2 x 6 stuff for rafters (which are a foot apart), with 1-inch boards* nailed on them at the top. 4 is the 3 ft. of dry earth between the two roofs, 5 representing the outside roof. 6 is the ventilator, showing the two elbows, which effectually exclude all light. The hole in it is 6 x 8 inches square. 7 is the sub-earth ventilator, which is 4 feet deep, as far as may be, and 100 feet long; but, as I have said before, this and the upper one are closed of late, winters, while the bees are in the cellar. As I have often expressed, I believe this is the best underground arrangement possible

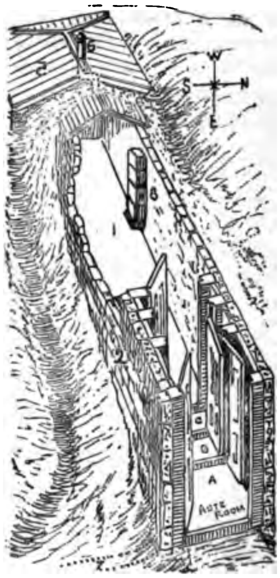
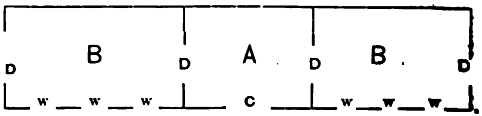


FIG. 3—BEE-CELLAR WITH ROOF TORN AWAY.

for wintering bees, and I have tried to make it all plain, so any person can build one who desires. The cost to me was not far from $80.00; but, of course, prices of lumber, stone, and labor, vary in different localities. G. M. DOOLITTLE.

Borodino, N. Y., Jan. 7, 1888.

Mr. H. R. Boardman uses a repository like that shown in the engraving with the hive-cart. The diagram below will give the plan of the building. It is divided off into three compartments. A is an entryway;



GROUND-PLAN.

* In the summer of 1890 these boards had become rotted so much that the roof caved in. To prevent a recurrence of this, Mr. Doolittle uses stone flagging instead of the boards. If the latter were covered with tarred paper above and below, it might answer equally well, and, at the same time, be cheaper.—ED.

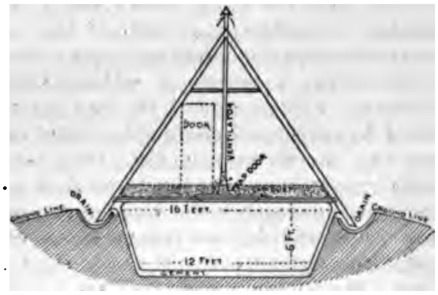
B B are places where the bees are kept. It is double-walled, 50 x 12 feet, one story, with walls 14 inches thick, packed. C is a doorway. To enter, we pass through C, close the door, and then enter the special compartments at D D. The entryway is 10 x 10 square, leaving B B each to be about 24 x 10, each being calculated to hold from 75 to 100 colonies. The diagram just shown gives an inside view of one of the compartments. W, W, W, etc., are windows hinged at the middle in such a way that, by reversing to a horizontal plane, bees that are collected on the inside can easily pass out. An inside close wooden blind serves the purpose of darkening, as well as keeping out the extreme cold. But an objection to an upground repository is that it is too subject to extremes of temperature. A repository like the Doolittle, or, better, like the next following, would be better providing it can be kept dry.

THE BINGHAM BEE-CELLAR.

The accompanying illustration, together with a sectional view, shows almost the entire detail of this cellar. It is cheaply constructed, and is, perhaps, the best wintering-repository of any that I have so far shown.

THE BINGHAM BEE-CELLAR.

The cellar bottom in this case is 12 ft. square (though it can be of any size), and the sides slope a little so as to make the top 16 feet square. The sills upon which the superstructure rests are 2 x 12 inches, and 18 feet long, and lie flat in the grout of which the sides and bottom of the cellar are composed. The roof, an ordinary cheap gable, made of dry one-inch boards, extends below the level of the ground, and discharges its water into conductors leading to a lower ground. The floor above the cellar is 2 inches thick, composed of dry one-inch boards. Access to the cistern, for that is really what it is, is ob-



tained by means of a trapdoor of the same thickness as the floor, with an easy stairway to the cellar bottom. A thick layer of sawdust covers the whole floor between the upper and lower compartments, making the cellar proper *absolutely frost-proof.*

Mr. Bingham says the total cost of his repository, made as described above, was between $50 and $55, and that its capacity is from 175 to 200 colonies. He has wintered 90 colonies in it with extraordinary success, the death-rate being only about 2 lbs. of dead bees per month for the 90 colonies.

A ventilator-tube (incorrectly shown in the sectional view) is a sixteen-inch conductor-pipe, reaching just through the ceiling of the cellar, and running up through the peak of the roof. This affords the only ventila-

tion that the bees have. Mr. Bingham says the value of the modifying or upper room will be better understood when it is known that it is really a part of the cellar, and not merely a part of the roof.

But the chief feature of this cellar lies in the fact that it is *wholly under ground.* The average bee-cellars, especially if they are under a house, are two feet out of the ground, or just enough to admit of ordinary cellar-windows. This portion of the wall not protected by earth, and coming in direct contact with the air outside, has a tendency to modify the temperature inside, so that during very cold weather the temperature will drop below the desired point, and in very moderate weather will run above the high point. Mr. Bingham says that his bee-cellar, *all* under ground, and protected as it is with a sawdust floor and modifying room above, never varies more than 4 degrees during the entire winter, being below 50 all the time, and at no time as low as 45. This is important in a bee-cellar, especially in climates subject to extremes.

Most clay soils, if the sides were made sloping as shown in the diagram, would not require brick walls, so the expense of the brick could be dispensed with, and only cement used to keep out the water and prevent the earth from crumbling.

WHEN TO TAKE BEES FROM THE CELLAR.

If they do not get too restless, I would allow them to remain until the soft-maples, or willow and alder, begin to furnish pollen. Put them out very early, in the morning of a warm pleasant day, if you can tell what morning will develop into a pleasant day. Set each hive out so quietly that none of the rest will be disturbed, if you can.[258-631]

After they are all out, and nicely fixed as they were the fall before, keep a close watch that the weak ones do not swarm out, as they are quite prone to do after their long confinement.[259 635]

WHAT TO DO WHEN THE BEES ARE RESTLESS IN THE CELLAR.

Along in February or March, possibly a little earlier, when the bees are inclined to become restless, we have found it a most excellent idea to let in copious supplies of fresh air at night, closing the doors or windows before daylight, for it will not do to let a strong light shine in the cellar very long. But when this does not answer, and it is too early to put the bees out permanently, we wait for the first warm day to come, when the sun shines good and bright, and the air is reasonably warm. Then we set all of the bees out of the cellar, putting them back in their old location. During the time they are out they have a good cleansing flight, for the accumulated feces in the bowels make them uneasy; and when their intestines are once cleared they get over their uneasiness when put back in the cellar. Hence we leave the bees out only during the day; and at night, when it gets to be a little cooler, the hives are all set back in the cellar again.

This involves, it is true, considerable labor, and some prominent bee-keepers believe it is only a waste of time. But our own experience is quite to the contrary. It does not take more than half a day all told to take fifty or even a hundred colonies out of the cellar and put them back again. But suppose it takes a whole day. We are satisfied from our own experience that the operation saves a good many colonies. We once removed half the bees for a cleansing flight, and put them back again. Those that had a flight remained quiet in the cellar, while those that had not had the flight were still uneasy, and continued to fly out on the cellar bottom and die, until we gave them a cleansing flight, when, presto! all was quiet again. In colder climates it may not be necessary to give the bees a mid-winter flight; but in our locality the weather warms up at times, making the bees more or less uneasy in the repository. The activity causes them to consume their stores, resulting in the clogging of their intestines. For that reason the bees should be given an opportunity to clear themselves. The question, then, whether bees shall be allowed to fly at all during mid-winter and toward spring will depend largely on the locality.

DEAD BEES IN THE CELLAR.

Do not be alarmed if dead bees get on the cellar bottom. They may accumulate to the depth of half an inch, or possibly more, if you leave them. I would advise sweeping them up two or three times during the winter.[260 639] Those bees that come out may be superannuated; but if they are uneasy from too long a retention of feces, the remedy should be applied as above directed. If you see bees on the floor that are swollen or distended, it indicates dysentery, or that something is wrong.

WHAT TEMPERATURE TO KEEP CELLARS.

While upground repositories are more convenient for carrying bees in and out (no cellar stairs), they have the one disadvan-

tage of being subject to considerable range of temperature, those only partially under ground being perhaps excepted. A good cellar, on the other hand, would be less affected by outside temperature. In the cellars that we use the temperature at no time goes above 50, and rarely below 40; 45 seems to be the average temperature, and most bee-keepers would have this temperature if they could, and maintain it. Some go so far as to argue that the temperature should not vary one degree. Our own experience, as also that of Mr. H. R. Boardman, seems to prove that an absolutely uniform temperature is not essential, but that extremes are detrimental. I would not have the temperature go above 50 or 55, if I could help it, nor below 40. *But it is important not to have it go above 55.*

ARTIFICIAL HEAT IN CELLARS.

A good many formerly used stoves in the cellar. G. M. Doolittle and Dr. C. C. Miller both used them pretty thoroughly. Mr. Doolittle has abandoned their use altogether. Dr. Miller still uses one,[643] and I am not so sure but they are a real benefit at times. When the temperature remains several degrees below zero, as is the case with Dr. Miller, and that continuously for a week or more, it is advisable then to raise the temperature, if it is below 38, by the use of artificial heat. As it will be inconvenient for many to make use of a common stove in their cellar, an ordinary coal-oil stove or a couple of good lamps will answer very well in lieu of it. The lamps or stoves, however, should be shaded by something on all four sides, so as to shut off the light. Instead of using lamps, some use ordinary square cans filled with hot water. If these are left in the middle of the cellar over night, they will make quite a difference in the temperature. On the whole I would dispense with artificial heat if possible; and I am not so sure that it is necessary, even when the temperature does go down as low as 35. Stoves in the cellar have probably done more harm than good.[261] But from what I am able to gather now from a large correspondence, and our own experience, I am inclined to think that it is beneficial, but only when the temperature has been below 38 for several days.[647]

VENTILATION OF BEE-CELLARS.

Our own experience goes to show that not enough attention has been given to the ventilation of the cellar itself. As to the manner of supplying the air a good plan is to open a door or window at night and close in the morning. Some bee-keepers have advocated shutting the bees in the repository, never opening the doors or windows, or at most only rarely. In such cellars there will be a number of dead bees on the cellar bottom; the live bees will be restless, the cellar foul, and every thing reeking with dampness from the breath of the bees. We have tried shutting bees up in our own cellars without giving ventilation for days. We have also tried giving ventilation, and our own experience is decidedly in favor of copious supplies of pure air, but only at such times as when the weather is warm outside or moderately so. If bees are reasonably quiet, and the temperature outside is considerably below freezing, I would not advocate opening the cellar more than about twice a week, and perhaps not as often as that. Keep the air as sweet as possible; and then if the bees are uneasy, flying out on the cellar bottom, and dying in great numbers, when the first warm day comes set them out and let them fly, then put them back as before recommended. If the cellar is constructed like Mr. Bingham's just described, with a large perpendicular ventilating-flue, it may not be necessary to open doors or windows.

VENTILATION, AND ITS RELATION TO THE SIZE OF CELLARS AND THE NUMBER OF BEES.

Cellars should be large in proportion to the number of bees kept in them. A room 12 by 12, and 7 feet deep, will winter 50 colonies much better than it will 100. Ten colonies will come through in better condition than 50. The reason of this is simply a question of pure air. In some cases one may have access to a larger cellar that opens up into other compartments. If these compartments are not used, leave the doors open so that the entire air of the cellar will be made available to the bees. If one has a bee-cellar only 10 by 10, 7 feet deep, he should not attempt to winter more than 100 colonies in it, and he will get better results with 50. If he has a larger number he can, of course, crowd them in, and they will winter properly if enough ventilation can be given during the day, and especially at night, and if, too, the temperature can be kept down to about 45.

SUB-EARTH VENTILATORS.

The sub-ventilator should be from four to six inches in diameter, made of tile, about 100 feet long, and from four to six feet below the surface of the ground. The outer end is

brought to the surface of the ground, and the inside end opens near the bottom of the cellar. The cold air entering the ventilator is warmed while in its passage under the ground; and when it enters the cellar it not only supplies the latter with pure air, but at the same time raises its temperature several degrees. Almost all bee-keepers, though, who once used sub-earth ventilators have abandoned their use. It is generally considered now that they are a useless expense; and while they may be of advantage at times, they are more apt to be detrimental.

DOES IT DISTURB BEES TO ENTER THE REPOSITORY WITH A LIGHTED LAMP?

This question is often asked. At times it evidently does create some disturbance; but usually, if you enter the room quietly, being careful about making unnecessary jarring, and avoiding loud talking, and remaining for only a short time, little if any harm will result. I would not enter the cellar or repository unless necessary. If the temperature goes down *outside* to or about zero I would ascertain the temperature in the repository. If below 35 I would raise the temperature by artificial heat. If very warm outside, and the temperature is above 50 in the cellar, and the bees seem to be restless, ventilate at night, when it is cooler.

HOW TO EXAMINE COLONIES IN THE CELLAR, WITHOUT BOTTOM-BOARDS, WITHOUT OPENING A HIVE.

With a small hand-glass and a lamp, enter the cellar quietly. Hold the glass beneath, and a little in front of one of the hives which are to be examined. With the other hand, hold the lamp so that the light strikes the bottom of the hive. Now tilt the glass at such an angle that the bottom of the hive can be seen in the glass. The condition of the bees can be very eas ly learned. If they are in a nicely compacted cluster you may rest assured that they are as they should be. As a general thing you will find them in plain sight on the central frames, just over the openings. Sometimes the ball will be hanging a little below. With a hand-lamp and a glass I find I can generally see nearly all parts of the hive inside. A dark lantern is much better than a hand-lamp; for with this you can shoot the light just where you want it. As the light is concentrated in one place only, it is less liable to disturb the bees elsewhere.

WHAT KIND OF STORES ARE PREFERRED?

I prefer stores made of granulated-sugar syrup sealed; but good combs of sealed *white* honey are nearly as good. As a general thing, bees will winter on dark honey, if well ripened and sealed. I certainly should not go to the expense of extracting it and then feeding syrup. Dark honey is a little more apt to give dysentery, but usually it does not.

WHEN TO USE THE OUTDOOR AND WHEN TO USE THE INDOOR METHOD OF WINTERING.

The answer will depend upon the weather conditions. If one has in his locality cold weather that lasts nearly all winter, with only now and then a day of temperature above the freezing-point, I would recommend by all means indoor wintering; or if the weather conditions are such that there is a month of cold weather ranging from 10 degrees above to 10 below zero, then a warmer spell a little above the thawing-point, followed by three or four days of weather at that temperature, followed again by freezing weather, such weather continuing clear up till actual springtime, then I would advise the indoor method. But if, on the other hand, the winters are somewhat open, there being perhaps a month of zero weather, followed by a month of warm open weather, continuing thus through the winter, the bees should be wintered outdoors in double-walled hives. We *may* have in our locality a month of real cold weather, but two weeks is about as long as it lasts at a time, when we will have a general breaking-up, a thaw, and perhaps rains. This will last for three or four weeks, when we will have another cold spell, lasting possibly a month. This kind of weather will continue in alternation till along in April. In such a climate the beginner will do far better with the outdoor method.

SPRING DWINDLING.

I do not know whether to style this a disease, or a condition of things that comes about naturally during cold and backward springs. I should incline to the latter, were not its ravages so uncertain; that is, it seems to affect a part of an apiary and not another part; and, at times, it will go all through one apiary, while another, a few miles away, will be entirely free from it. It is very certain that it afflicts weak colonies, as a general thing, more than strong ones, but there are exceptions even to this. It is much worse after a long, hard winter, and it disappears always at the approach of settled warm weather and new honey. Although it does not generally seem to affect stocks before March, I have seen them af-

A WINTER VIEW OF OUR OWN APIARY OF OUTDOOR WINTERED COLONIES.

fected by it from February till June. I have even known colonies to be listless and lifeless from its effects until others in the apiary were sending out rousing swarms. Strong colonies that are raising brood vigorously seldom *seem* affected by it; but I suspect they *are* affected more or less by it, or by the condition of things, but have sufficient vigor and strength — animal heat, if you please — to pull through until there is plenty of warm weather, new pollen, and new honey.

Spring dwindling of late years is not nearly so prevalent as it was during the '80's.

CURE FOR SPRING DWINDLING.

As I have said before, I know of no positive cure except warm weather, and this always does away with it entirely; were this not the case, I should hardly be willing to class this great drawback to successful bee culture under the head of wintering. The question now arises, Can we not, by the use of artificial heat, bring about such a state of affairs as is produced by warm weather? In other words, can we not, by going to the necessary expense and trouble, save our bees and queens, even though seasonable weather does not come? Many experiments have been made in the matter, and some of them, apparently, have succeeded; but, on the other hand, many of them have signally failed. I have started healthy brood-rearing in every month in the year, by means of artificial heat; but to take a whole apiary that is running down, in the month of April, and build it up, prevent the colonies from swarming out, and the queens from deserting and dying, is something I have never succeeded in doing.

WHAT TO DO WHEN YOUR BEES GET "SPRING DWINDLING."

Look them over every few days, if necessary, and close up the division-boards, taking out all combs they can not cover. We used to advocate uniting when they became so weak; but we have found that uniting several weak ones does little if any good. Both Dr. Miller and G. M. Doolittle agree, as you will see by the comment,[262,655]. If you have the real dwindling, you will find queen-cells started and queens missing, at almost every round you take among the hives. This is because the colonies have become disheartened and demoralized; and the only thing that will prevent this demoralization is to contract them until there are numbers enough to repel the frost.

It may be asked, What becomes of the bees? I believe they generally fly out of the hives, and never get back again. During cool sunshiny days they may be seen on the fences and sidewalks, on the grass and like places, often laden with pollen, showing clearly that they are trying to make a live of it, and doing the best they can.[363] I have sometimes thought they became so chilled in their meager clusters at home that they had not sufficient vigor to withstand the chilly spring winds as a bee from a powerful and prosperous colony would. As the Italians are more eager for stores than the common bees, it may be that this is one reason why they are often said to be more liable to this dwindling than the common bees.

Those who rear queens and bees largely late in the season are apt to suffer more from spring dwindling than those who let their bees alone after the honey harvest, providing they were good and strong along in August and September. Many contend that we must go into winter quarters with *young* bees. If it is the old bees that die off so rapidly on account of the loss of vitality, then the advice (that we should have young bees) is good. We have wintered bees well with only *old* bees, and that 200 colonies, one winter, without the loss of a single one. But the winter was favorable, and so perhaps that may not influence the argument one way or the other. However, I think it is safer to have as many young bees to go into winter quarters as possible. What I mean by "young" bees is those that have not borne the toil of the season, or at least only the latter end of it.

WHAT TO DO WITH COMBS FROM HIVES WHERE THE BEES HAVE DIED.

Put them safely out of the way of bees, either in tight hives or in a bee-proof room: and if you have not bees enough to cover them by the middle of June, or at such a time as you shall find moth-worms at work among them, be sure that all the combs are spread at least two inches apart, as recommended in BEE-MOTH. Now, whatever other precautions you take, you *must* look after these empty combs occasionally. They are very valuable, and must not be allowed to be destroyed. A very good way to keep them is to put them in empty Dovetailed hives, piled one over the other. This keeps them perfectly protected, and yet you can quickly look them all over as often as once a week at least, until they are used. But, suppose they do get moldy, or full of worms, what then?

WHAT TO DO WITH COMBS THAT ARE SOILED, MOLDY, AND FILLED WITH DEAD BEES.

When I wrote the article on DYSENTERY I forgot to mention what should be done with the combs after the bees had died. Many times you will find the cells full of dead bees; and any one who has tried it will know what an endless task it is to try to pick them out. Well, do not try; but just take these combs and set them away until you want empty combs to build up stocks, and then hang them, one at a time, in the center of a populous colony. After a few hours, just take a peep at your comb, and see how the bees do it. If it is at a season when honey is coming in, it will have undergone such a transformation that you can scarcely believe your eyes when you come to take a look at it. I have put in combs that were full of dead bees, filthy from the effects of dysentery, and moldy besides, and found them in the afternoon of the same day, clean, bright, and sweet, holes patched up, and partly filled with eggs, honey, and pollen. In one case I hunted the hive all over for my bad comb, and then came pretty near declaring somebody had taken it away; there was no comb there that could be identified as the bad one. Do not extract the honey, pick out the bees, or fuss to wash them off with water; just let the bees try their hand at it, and see. Do not give them too many bad combs at once, or they may get discouraged, and swarm out. Give them one; after a few hours, another; and you will very soon have them all right. How do they do it so quickly? Well, each bee takes a cell; and when it has its cell finished, they are all done.

WINTERING IN THE SOUTHERN STATES.

The directions so far given apply particularly to localities that are subject to zero weather at times, that have more or less of snow, and, during the greater portion of the year, a large amount of frost in the ground, extending down perhaps two feet.

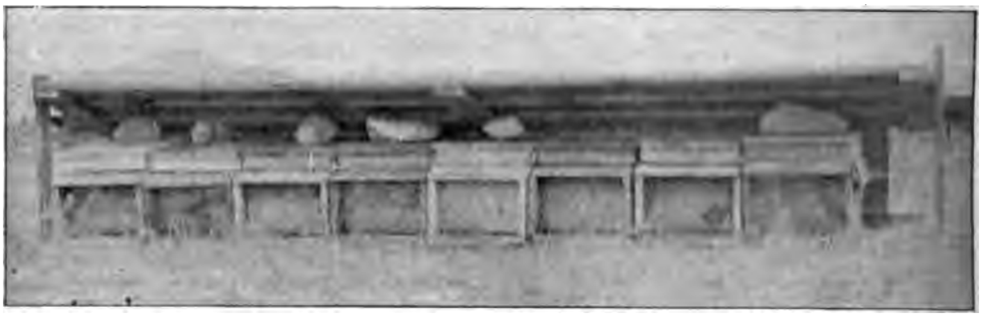
Where bees can fly almost every day in the year, and for ten months in the year can gather a little honey or pollen, outdoor wintering in single-walled hives is recommended. Double-walled hives would do no harm, and might, during the coldest of the weather, save a little brood; but it is doubtful whether the added expense for the extra walls and packing will compensate for the possible slight loss of brood and bees during a few cold days. While I would recommend single hives for the southern portions of our country, and for some parts of the West, I would always urge that the same be located in an inclosure of trees—a tight high board fence, a hedge fence, or any thing in the way of buildings that will afford a windbreak against the prevailing winds. The establishing of windbreaks is one of the most important requisites in either the northern or southern portions of the country.

While it is no great trick to winter bees in such localities as are found in Florida, South Carolina, Texas, Louisiana, Georgia, Alabama, South Carolina, yet one must be careful to see that his bees do not run out of stores, as it seems to be a generally acknowledged fact that bees wintered in the South consume a much larger percentage of stores, according to the size of the colony, than those in the North. Those in cold climates are compelled to contract into a very small ball for the purpose of concentrating the animal heat; and while in that condition they go into a sort of semi-dormant state, during which they consume a comparatively small quantity of food. On the other hand, bees in the South, especially in the warmest portions, will have access to all parts of the hive, will be rearing more or less brood, and, as a consequence, when natural flora does not secrete nectar they will be liable to run short of stores, and starve. To the Southlander let me urge that the greatest danger is starvation, and the next greatest is more or less of robbing during a dearth of honey. Indeed, all things considered, I believe that the Southern bees require more watching than those of the North.

In localities like Virginia, Tennessee, and other States lying in about the same latitude, it might be advisable to use double-walled hives: but we do know that the majority of bee-keepers in that latitude winter their bees successfully in single-walled hives; but I believe it is the general practice to place on top of the hive a super containing chaff, leaves, planer-shavings, or some good warm packing-material: then if the colony is not very strong it is advisable to place a chaff division-board on each side of the cluster. In all cases the bees should not be given a larger cubic capacity than they can comfortably fill with bees spread out as they usually are on a day when the temperature is not below 70 F.

In Colorado it is customary to winter in single-walled hives. A shallow cap or tray containing an inch or so of packing is placed on top of the hive. Very often, for further

protection, a sort of shed or roof, as shown in the accompanying illustration, with its back to the prevailing winds, is built over a row of hives. The Colorado bee-keepers are troubled some with sandstorms, and with fierce piercing winds; and while the temperature may go down below zero, it is not likely to remain so for more than a few hours, when one extreme will be changed for a temperature of 60 or 70 F., and the bees flying. For such conditions double-walled hives, and an excess of packing-material, has been found to be not at all necessary.



TEMPORARY SHED FOR WINTERING BEES IN COLORADO.

Answers to Questions from Beginners.

Although this book is supposed to cover every subject upon which beginners desire information, that information or answer may be scattered over several pages. Then, again, it seems impossible to write a general text-book so that it shall cover every condition that may arise. To fill this want, a department with the heading as above was begun in *Gleanings in Bee Culture* several years ago. If the answers to these questions have been found helpful to readers of *Gleanings* we have thought they might be equally helpful to the readers of this book, embodied in permanent form. The answers are by E. R. Root, who, as you will see by the preface, has re-written a large part of this work. To facilitate reference, the questions are classified under headings, as will be seen upon the following pages; that is, there will be a list of questions and answers under "Comb and Extracted Honey;" under "Feeding," and so on through the list. Those that can not well be classified are put under "Miscellaneous.'

Comb and Extracted Honey.

C. B. B., of Texas, would like to know how many pounds of starter foundation it requires to make 1000 lbs. of section honey. *Ans.*—We figure, on the full sheets, 4¼ sections, about 10 lbs.; for smaller sheets, proportionally less.

K. A. M., of Ohio, inquires whether it is necessary to wire shallow or half-depth frames for extracting. *Ans.*—We would advise putting in two wires—first, to fasten the foundation centrally in the frames; and, second, to prevent any liability of the combs breaking out.

J. P. P., of Iowa, asks, "If ¼ as a bee-space between super and frame is right, why not between top-bars and frames above?" *Ans.*—There ought to be the same bee-space in both cases; but practically there is a slight difference in the Dovetailed hives as we now make them. We are not able at present to equalize the spaces exactly, without running into a snag still more objectionable.

E. N., of Illinois, asks if the bees will not store more surplus over drawn combs than over starters only, in the brood-frames. *Ans.*—No. It would, rather, be the other way, provided that the bees were hived on the starters, and honey was coming in with a rush at the time. If they had drawn combs below, they would pile the honey into the brood-frames, and put in the sections what remained. E N. also asks whether Italian queens reared in a colony of black bees would not be more prolific. *Ans.*—We do not think it would make any difference.

P. W., of New York, writes: "Please tell me what I can put on the separators to keep the bees from fastening the honey to them. They spoil lots of boxes on the new boards." *Ans.*—This is a difficulty that practical bee-keepers find to a slight extent, but, so far as we know, not enough to make any great trouble. In your case it may be that the hive did not stand level; that the foundation was not perfectly centered in the sections, or that the sections themselves did not have wide enough openings. Any and all of these might combine to aggravate comb-attaching.

H. C. R., of South Carolina, asks what causes honey to sugar in the hive during midsummer. *Ans.*—We can not explain the reason, only that we know that honey from some sources has a peculiar habit of candying almost as soon as gathered. If H. C. R. could tell us the source whence it comes, we might tell him more about it. He also asks, further, how to get this candied stuff out of the combs. There is no practical way that we know of. We would set aside the combs containing such honey, and use them for supplying bees with stores when they require it. In your locality you will, quite likely, require to use them before next summer.

S. P. J., of Florida, wants to know how to keep extracted honey from candying. *Ans.*—The only way we know of is to let it get thoroughly ripened in the hive—that is, evaporated down so it will be thick. Such honey, without any further treatment, will sometimes keep all winter without candying. As a rule, however, it is necessary to heat the honey over hot water to about 150°, and then seal it, while hot, in bottles or tin cans. But there is no method that is infallible. If possible the heating should not be resorted to, as some think that a little bit of the delicate aroma is lost. The Californians allow the honey to evaporate in large shallow vats until it becomes thick. Such honey will keep a long time without candying.

W. C. B., of Illinois, wishes to know whether it is advisable to take off the sections as fast as they are filled, or leave them on the hive until after honey-gathering is over. *Ans.*—In large apiaries it would hardly be practicable to take off every section as soon as it is nicely completed. The usual practice is to leave the crate on until most of the sections are filled out, and then remove it. The partly finished sections can be put together in one or more crates, and put back on the hives for the bees to complete, providing the honey season has not already ceased. The only objection to leaving the honey on longer than when fully completed is, that it becomes travel and propolis stained, and hence is less salable.

F. L. S., of Minnesota, wants to know what is the net profit per hive of bees in California. *Ans.*—We can make only a very poor guess. In a fair season a fair colony under good management, in a fair locality, ought to yield 75 or 100 lbs. of extracted honey, and 50 or 75 of comb, although these are conservative figures. Extracted in large lots will net the bee-keeper from 4 to 5 cts., or $3.50 per colony. The comb would net him about 10 or 12 cts., or $5.00 per colony. From this must be subtracted the cost of managing the bees, cost of foundation, cost of carting to the nearest railroad station or market, cost of square cans for the extracted honey, or shipping-cases for the comb honey—cost of sections, interest on the money, losses from absconding swarms, etc.

F. W., of Connecticut, says he has three colonies of bees in Dovetailed hives, and wants to know how he shall manage them to obtain the most comb honey. *Ans.*—This question requires too long an answer to be given here in detail, but in a general way we may say that early brood-rearing should be encouraged so that there may be a large force of bees a couple of weeks old when the honey season opens up. To procure either comb or extracted honey, this is the most important factor to be considered. A large force of bees of the right age, and a reasonable honey-flow, means honey. A small force of bees, or even a large force too young, means a practical failure so far as the production of honey is concerned. But our querist may ask how to start early brood-rearing. As soon as the weather opens up warm, feed the bees daily about half a pint of sugar syrup. It is assumed that the colonies have

been carefully packed in double-walled hives, otherwise there will be times when the brood will be chilled from this early stimulative feeding.

R. M. C., of California, has just extracted some honey from unfinished sections of last season, and desires to know whether it will start robbing to set these out where the bees can clean them up. *Ans.*—Instead of putting them outdoors where the bees can have a regular jubilee over them, said jubilee finally ending up in a row, put the sections in crates and stack them over the brood-nest of a strong colony. If the hives are made so that they may tier up one above another, this can be done very easily. Sections might also be put in stacked-up hives, without the full colony under providing the entrance is contracted to the space of one bee, so the bees could clear them out slowly, on the plan of gentle robbing, which of late has been practiced successfully. R. M. C. asks, again, whether it would be prudent to transfer in March. We do not see any reason why, in his locality, he could not do it almost any month in the year. The short method spoken of in our price list is the one we recommend.

J. E. M., of South Carolina, desires to know, 1, whether he should extract what honey the bees may have in their hives in the spring, so as to stimulate them to greater energy, or let them have what they may have. 2. "Do you recommend putting in full-sized sheets of foundation in sections?" 3. "Is it necessary to wire foundation in frames if we do not expect to extract?" *Ans.*—1. No, no. Leave the honey in the hive. It is poor policy to try to starve the bees to work, on the principle of "sink or swim." Let them have all the stores they have, and more too. 2. Yes. 3. No, it is not absolutely necessary, but decidedly advisable. Why any one should think wiring is unnecessary, when it costs so little to make a sure thing of the combs, is beyond our comprehension. The expense of the wiring material is about 10 cents per 100 combs; and the labor, if performed during the winter months, when nothing else can be done, is practically nothing. A few broken-down combs that have not been previously stayed by wires will pay for the cost of the work many times over.

W. H. J., of Ontario, asks how we ship comb honey. *Ans.*—We follow no invariable method. While we ship in 12, 24, and 48 lb. cases, we prefer the 24-lb. single tier. If we have half a dozen or so of cases to ship at once, we crate them up in such a way as to leave convenient handles at each end of the crate. On the bottom slats of the crate is piled straw deep enough to make a sort of cushion between the crates and said slats. The handles at each end of the crate tend greatly to insure careful treatment. As another precaution the cases are crated up so the glass shows on the outside. If freight-men see that the crate contains something easily broken, they will be more apt to handle with care. In shipping honey by the carload we recommend strewing considerable straw on the floor of the box car. The cases can then be piled up with spaces in between, so that the separate combs are parallel to the rails. Be sure not to put them in the car the other way. In small shipments we put on a caution label, printed in red letters, with a finger on one end. The directions below this are, to load with the finger pointing toward the locomotive.

J. V. M., of Ohio, inquires what we recommend for covering sections while the bees are working in them, and what sort of cover we use over the brood-frames when the sections are off. *Ans.*—With the Dovetailed hive, we use no other cover than the hive-cover itself. This will leave scant ¼ bee-space above the sections. But a great many — and we believe it is a decided disadvantage — put on the sections old carpets, old cloths, etc. So far as the amount of honey is concerned, these old cloths do not make any particular difference either way; but far cleaner sections, and hence comb honey that will bring a higher market price than that which is secured without the use of any carpet or cloths, will be secured, because many bee-men do not scrape their sections. Wherever the cloth comes against the sections, the bees will daub a line of propolis; and if they can push the cloths up they will chink in propolis in the crevices, providing it is less than a bee-space. Practically the same reasons apply for not using enamel cloths or any thing of the sort over the brood-frames. The thick top-bars have practically no burr-combs. If hives are properly constructed with bee-spaces, then cloths, old carpet, enamel cloths, etc., are worse than useless.

Feeding.

L. M. B., of Louisiana, says sugar is expensive, but New Orleans molasses is cheap. Would it be safe to feed the latter? *Ans.*—In your climate we should not be afraid to risk it, as we assume that the bees will have opportunity for occasional flights. The best sugar stores are not necessary, except in the extreme North; and even then the bees winter well on buckwheat honey, cheap molasses, and other inferior sweets. But up here in the North, granulated-sugar syrup, as it contains so large an amount of sweet for the money, is about as cheap as any thing that can be given to the bees.

J. D. B., of Michigan, wants to know if he can use percolator feeders as late as December, as described by Dr. Miller and myself on page 723 of *Gleanings in Bee Culture*, 1894. *Ans.*—No. The mere fact that the syrup is made of sugar and water, half and half, makes the syrup so thin that the bees have got to thicken it, and this they can not do in cold weather. The syrup should be made in the old way, and fed thick, in the proportion of two of sugar to one of water. Better still, feed early—not later than the middle of October.

L. V. T., of New Jersey, says that, the honey-flow having ceased, he has divided his bees, and would like to have them build up strong for the fall flow. He asks whether sweetened water would cause them to do this; and if so, is there any liability of its remaining in combs unevaporated or souring? *Ans.*—Sweetened water, given in small amounts daily, ought to cause the bees to rear enough brood so as to put them in fair shape for winter. Sweetened water will give no trouble, because the bees will soon evaporate it down. It is usually preferable to mix the sugar and water in about the proportion of two-thirds of the former to one-third of the latter, by bulk.

J. P. B., of Ohio, wants to know, 1, whether a hive 21 x 13 x 11 is too large to secure good results; 2. To obtain a big supply of bees early, should they be stimulated by feeding? 3. Do bees gather any stores from corn-blossoms? *Ans.*—1. No; but it is usually best to have the dimensions standard, so as to correspond with regular goods. 2. Yes, it is desirable to feed the bees a little every day, if they require it in the spring, or when the weather is settled enough so that they can fly almost every day. Feeding too early to stimulate is bad. 3. This is a disputed question. They do gather pollen from corn-blossoms, but it is doubtful whether they get any honey generally from them.

A. P. H., of Illinois, inquires whether it is too late to feed, Oct. 1. *Ans.*—If colonies are short of stores we would feed, even up to and into cool or cold weather; but the syrup should be next thing to hot when given to the bees; and if placed under chaff cushions, we think there will be no trouble about the bees taking it down; but when they are fed so late, the syrup should be a little thicker than usual. The usual proportion is 20 lbs. of sugar to a gallon of water. During cold weather we would make the syrup about 25 lbs. of sugar to a gallon of water, because during cold weather the bees will not be able to evaporate the honey down as well. If the weather is freezing, or down near zero, we would give the bees cakes of hard candy. Full particulars of how to make are given under the head of CANDY.

Bee Pasturage.

R. M. C., of South Carolina, wishes to know what kind of clover is best to sow for bees. *Ans.*—Alsike will grow everywhere that white clover does; and it is the kind of clover that we usually recommend. Four pounds of it should be sown per acre. It can be purchased of any of your dealers.

W. A. R., of Florida, asks what plants we recommend for honey in his State. *Ans.*—We would grow nothing that would not pay independently of any supply of honey that he might get from it. If there is an orange-grove, or field of alfalfa, in his vicinity, it would probably pay to move the bees to it.

H. H. B., of Pennsylvania, wishes to know whether we would recommend the Simpson honey-plant for his locality. *Ans.*—It is in some respects a remarkable honey-plant; and as it blossoms soon after clover, and continues in bloom till nearly frost, a small field of it goes a long way toward keeping the bees out of mischief, as they work on it from morning till night; but after having tested it carefully, the ex-

pense of setting out the plants and keeping them in order is, many times, more than can be gotten out of it. There are some places where it grows naturally; but it is not advisable to grow this or any other honey-plant that is not valuable aside from the honey it produces. Artificial bee-pasturage should be confined to the clovers, buckwheat, and seven-top turnip. See further, under ARTIFICIAL PASTURAGE.

S. F. T., of Illinois, wants to know how to make his bees work on buckwheat that is two miles distant from the apiary. *Ans.*—It is not always that buckwheat yields honey; and under such circumstances it would be impossible to get the bees to work on it, even if it were within a few rods of the apiary; and in the second place, bees do not usually work to advantage at points further distant than a mile and a half; so that, even if the buckwheat in question did yield a little honey, it would be "just a little fur off." In this connection it would be proper to remark that bees have been known to work, and work well, on fields two or three miles from the apiary. In some instances they have been known to go seven miles over water or over prairies; but all these are exceptions to the general rule.

Foundation.

W. B. R., of Virginia, asks us how we prevent the wax from sticking to the Daisy foundation-roller. *Ans.*—See that the roller is clean in the first place. Dip it occasionally in water while in use, and you will have no trouble.

B. F. H., of Canada, asks how long foundation may be kept. *Ans.*—The experiments conducted by R. L. Taylor go to show that old foundation is nearly if not quite as good as new. Foundation does become a little harder with age, but it may be softened by immersing in water that feels hot to the hand.

W. F. A., of Pennsylvania, desires to know how white wax is made. *Ans.*—Generally by the use of chemicals. See WAX. It may also be bleached by leaving it exposed to the rays of the sun, so as to be practically white. If the wax is left in the solar wax-extractor long enough it will become white.

O. H. H., of Illinois, asks whether, when putting foundation into brood-frames, the same should touch the bottom-bar. *Ans.*—Except for perpendicular wiring there should be a quarter-inch space between the bottom edge of the foundation and the bottom-bar. The foundation sags a little when the bees draw it out, and a little allowance should be made.

F. F. C., of Ohio, has 75 or 80 lbs. of wax, and inquires how many pounds of foundation he can get out of it. *Ans.*—You ought to get as many pounds of foundation of any kind as you have pounds of wax, less the impurities that may have been in the original cakes; and this, in case of good wax, is practically nothing. Of course, if you are slovenly and wasteful in your work you will have proportionally less foundation.

M. M. B., of Pennsylvania, has some 25 lbs. of last year's foundation. He says it is too old and brittle, and wishes to know if there is any practical way of restoring it to its former condition, or a condition soft enough so as to be used over again. *Ans.*—Some one recommended, some time ago, putting such foundation into a warm tepid bath for a while, and claimed that it would make it so the bees would take to it as readily as any foundation. We have never tried it, and can not speak positively as to whether it would work or not.

L. H. L., of Pennsylvania, wishes to know how much acid to use to a two-gallon bucketful of comb. *Ans.*—For wax that has not been rendered into cakes—that is, broken combs—more acid must be used. A good deal depends upon how old the comb is—that is, how many cocoons are in the cells themselves. At best, out of two buckets of comb only, you will not get very much wax. If you have a solar wax-extractor we would advise you to use that. A tablespoonful of raw sulphuric acid to about half a pail of water would be sufficient for the quantity of comb you mention.

T. E. H., of Arkansas, notices that we advertise starters for brood-frames, and would like to know how wide these starters should be. *Ans.*—They may be anywhere from half an inch to full width of the frames; but generally about half an inch is used. The main purpose of the starter is, to get the bees to build the comb centrally in the frames. Without starters there is danger that the bees, as you say, will build crooked combs, sometimes crosswise of the frames. The only way that we know of to make straight comb is, to use starters, or, better, full sheets of foundation, wired with horizontal wires.

W. T. H., of Iowa, wants to know, 1, whether our foundation-machines will make both brood and surplus foundation; 2, If bees are put in the cellar, a few yards from their old stands, and then allowed a flight occasionally during warm days, will they go back to their old stands? *Ans.*—1. Our standard 10-inch mill is made so as to make both brood and surplus foundation, a change from light to heavy being made by adjusting the screws, about as you squeeze wringer-rolls down to dry the clothes out more. 2. When bees are put in the cellar they should be kept there, and not allowed a flight until they are set out permanently next spring. Experience has shown that it is bad policy to move bees in and out of the cellar every warm day.

C. C. M., of Ohio, asks what time of the year is best, and what condition the bees should be in, to produce all worker-cells from wired foundation in brood-frames. *Ans.*—At any time of the year, and under all conditions, so far as we know, you can secure worker comb from worker foundation. During the height of the honey-flow, with only starters of foundation, the bees are apt to build drone comb, because they can make this quicker, and thus sooner have a receptacle in which to store their hard earnings. Drone comb may result from worker-foundation, providing said foundation is adulterated with paraffine or ceresin wax. But we believe that there are no foundation-makers in this country who make use of anything but pure beeswax. Nothing else seems to answer, for other things have been tried. See WAX.

Swarming.

M. S. W. asks if he can Italianize easily at swarming-time by putting drone-traps over the entrances of colonies having impure drones. *Ans.*—Yes.

C. P. H., of Iowa, inquires whether it will prevent swarming to introduce a young queen. *Ans.*—No; but colonies with young queens are not quite so liable to swarm as those with older ones.

W. H. S., of New Jersey, has a large lot of second swarms, all of them weak, and he wants to know what to do with them. *Ans.*—We would first see that each has a laying queen; and then by stimulative feeding we would cause them to rear as much brood as possible, so as to be of good strength for winter. If so many colonies are not desired, unite them. See further, under head of UNITING.

G. A. C., of Tennessee, wants to know how to move a swarm of bees that has clustered on the trunk of a tree. *Ans.*—Blow a little smoke on them to cause them to be a little more peaceable, and then with a brush, or handful of heavy weeds, brush the bees into a large tin pan. The brushing should be accompanied with a few whiffs of smoke, otherwise the bees may be angered.

J. W. M., of Michigan, has a good many empty hives filled with honey from which bees have died during the winter. He wants to know if he can hive new swarms on them again the same summer. *Ans.*—Yes, sir. Those hives will be as good as any, and the new swarm will very soon sweeten things up if the hive has been befouled with dysentery. But the entrances should be kept closed, otherwise there will be robbing.

L. L. W., of Virginia, asks whether bees can be kept from swarming by cutting out queen-cells. *Ans.*—The cutting of queen-cells only discourages swarming. For normal colonies run for comb honey, we know of no method that will absolutely prevent swarming invariably. For extracted, the matter is far easier. Giving lots of room, both to the queen for brood-rearing and to the bees for the storage of honey, will generally prevent swarming.

H. N. J., of New Hampshire, says he has 20 colonies of bees; but as his business calls him away through the swarming season, he wishes to know how it would do to put Alley drone-traps on, and catch the would-be runaway swarms. *Ans.*—This can be and has been done, although an attendant, soon after the swarm returns and clusters about the trap, should remove the bees and hive them in a new hive. We should prefer, however, to use the Pratt automatic hiver.

ANSWERS TO QUESTIONS FROM BEGINNERS.

G. R., of Indiana, wants to know what to do with [illegible] [illegible]

R. F. R., of Virginia, asks [illegible] [illegible] are wanted [illegible] [illegible]

J. E. L., of Virginia, [illegible] [illegible] If the bees [illegible] [illegible] with a frame of brood above, and empty frames on each side.

E. R., of West Virginia, asks: "Can I use perforated zinc as a screen on the entrance of the hive during the swarming season, to prevent swarming? If not, why not?" *Ans.*—Yes, you can; and to a certain extent it will check, or rather, prevent, runaway swarms; but it is, to a greater or less extent, unsatisfactory. The bees must either be gratified in their natural desire for swarming or they will fritter away their time in making unsuccessful attempts at swarming out, trying to get the queen to go out with them; and their failure to thus accomplish their purpose will [illegible] their work [illegible] their queen; and in all probability the honey season will have gone by, and no honey will have been gathered. If you have an out-apiary, entrance-guards may very often be used to advantage; but we should prefer to use the Pratt automatic hiver. See SWARMING.

J. R. C., of California, wants to know how to get bees out of rocks. *Ans.*—If you want to have a little fun, blast the rocks; but perhaps you may then get neither bees nor honey in shape to be of any service. We do not know how the bees can be gotten out except by trapping them out with a bee-escape. Keep the escape on for three weeks till every last bee has gone out. In the meantime put the first catch of bees in a hive on the outside, near the entrance of the rocks. After the bees have all hatched out, and gone from the cavity in the rock, we are of the opinion that, if the escape were removed, the bees now in the hive would rob the honey out of the rock, and put it into their new quarters. J. R. C. asks further whether turpentine or any other liquid of strong scent, if poured into the entrances, would probably drive the bees out. *Ans.*—We do not know. Possibly a weak solution of carbolic acid poured in might drive them out. Try it and report.

J. K. R., of Illinois, has a colony of bees in a tree in the dooryard. Not desiring to cut the tree, he would like to know how to get the bees out. *Ans.*—That is a rather difficult job. If there is any other hole to the cavity in the tree. In the absence of one, one can be made with an auger; a stream of smoke could be blown in, driving all the bees, including the queen, out at the entrance. Before they can return, plug both holes up, and then hive the bees in a hive near the tree—of course, keeping the old entrance in the tree plugged up tight for two or three weeks, or until the bees are entirely accustomed to their new location. If it is impracticable to use any smoke, place a wire-cloth cone bee-escape over the hole in the tree. Not a bee, as it comes out of the tree, of course, can get back; and if the escape be attached on a warm day, when the bees are flying heavily, there will be quite a swarm cluster on the [illegible] These may [illegible] [illegible] will [illegible] Leave [illegible] and then put [illegible] the brood and [illegible]

[illegible] know how [illegible] from [illegible] He [illegible] a [illegible] always [illegible] He also [illegible] like a [illegible] bees [illegible] but in [illegible] cause [illegible] It is [illegible] better [illegible] among the [illegible] upon any [illegible] 2. A mold [illegible] might be [illegible] of [illegible] that the [illegible] when it is cold. [illegible] upon the [illegible] be the [illegible] \$1 [illegible] will [illegible] made, though [illegible] it. 3. We [illegible] Norway spruce [illegible]

Transferring.

J. W. M., of Arkansas, wishes to know whether the [illegible] from which the bees have died, [illegible] frames. *Ans.*—[illegible] them will be [illegible] into wax.

S. W. P., of [illegible], asks whether bees can be transferred [illegible] *Ans.*—Any time when bees can [illegible] so that they will have time to patch up the combs and take in a little extra syrup if it should be necessary.

G. A. M., of Ohio, wants to know whether bees can be transferred successfully by the Heddon short way during the latter part of August. *Ans.*—They can. In fact, that is a very good time to do it. Any time is good to transfer when the bees are not working heavily in the fields, though perhaps the best time in the year is in the spring.

H. C. C., having read our article on transferring, in our price list, wants to know when transferring should be done. *Ans.*—Preferably in the spring, when bees are getting a little honey from some source; and when, too, there is very little honey in the combs. However, we transfer any time during the season. Mr. Heddon's short method is the one we prefer.

J. P. G., of Kentucky, referring to the Heddon short method of transferring, would like to know whether there is any danger in leaving the old hive with the few bees to take care of the brood, honey, and combs. *Ans.*—No, there will be enough bees to take care of it; but the entrance should be contracted so that the few bees may be better able to resist robbers.

B. T. S., of West Virginia, asks how to get a black queen out of a patent hive, without movable frames. *Ans.*—Turn the hive upside down, if it has an open bottom, and place over it a small inclosed box, on the under side of which is a hole smaller than the patent hive. Drum on the sides of the hive until all or nearly all of the bees run up into the box. Presumably, the queen will go with them. As black bees run and scamper over each other, it is very difficult to find the queen, especially if you are not an expert. Place perforated zinc over the hole in the box; set the patent hive back on its stand, or, better, put a new hive with movable frames on the old stand. Now place the box, with its perforated zinc, in front of the hive; smoke or drum the bees out. As the queen is larger, she will not be able to pass the perforated zinc, and will be detained in the box. If no zinc is at hand, shake the bees all out on the ground in front of the hive, a short distance from the entrance; and then, as they crawl into the hive, look sharp for the queen. We might add, as a sec-

ond thought, that it may be better to put the perforated zinc in front of the entrance. The queen will, of course, be barred from passing into the hive.

Queen-rearing.

H. D. P., of Kansas, inquires whether, if he begins with the pure Italians, they will be likely to remain pure. *Ans.*—They can be kept pure by using perforated zinc, and destroying the impure drones in the neighborhood. See further, under head of DRONES.

T. B. S., of Arizona, wants to know where the royal jelly comes from for grafting queen-cells after swarming-time. *Ans.*—Usually there will be cells enough from the queenless colonies in the various parts of the apiary, containing royal jelly with which to supply grafted cells.

W. A. A., of Texas, sends us a drone having a white head. *Ans.*—The drone is a regular "sport." Although the head is white, it is of a greenish cast. These are simply a freak of nature, or what may be properly called "sports." This sporting, so far as the variously colored heads are concerned, seems to be confined entirely to drones. See DRONES.

B. B. Y., of North Carolina, writes that some time ago he hived a swarm of hybrid bees that had six or seven queens, and that a neighbor who keeps bees in "gums" reports a swarm with several queens. *Ans.*—A swarm is quite apt to have more than one queen with it, especially if it is a second swarm. In that case there may be four or five virgin queens.

J. A. S., of Virginia, desires to get as many Italian drones as possible from his two Italian colonies. All the rest of his stocks are blacks. *Ans.*—Uncap all the drone brood in the black colonies. Give the two Italian colonies each a frame of drone comb, putting the combs in the center of the brood-nest. If no honey is coming in, feed them about half a pint of syrup daily. As soon as drones from Italian colonies are hatched out and ready to fly, put drone-guards over the entrances of the black colonies, and the chances are that your queen will be fertilized by Italian drones.

A. K. T., of Illinois, desires to know when it is the best time to requeen. *Ans.*—During the swarming season. A number of nice and choice cells will be at hand, and hybrid or other undesirable queens can be disposed of, and the choice cells put into queen-protectors can be given to the colonies. This will, for the time being, stop all swarming; and by the time the young queen is laying, all ideas of swarming will be given up. There is no use of talking, we get better queens from cells reared during the swarming season. We formerly disputed that, but we now take it all back.

R. N. L., of Nebraska, asks how far drones and queens will fly from the apiary in mating. *Ans.*—No one can tell positively; but it has been observed that, of two apiaries five miles apart, one containing Italian drones and the other black, there will be hybrids in both in time, even when it is known that there are no bees between—certainly no Italians except those in the Italian apiary, showing that, if the queens and drones each fly about half way, it would make it 2½ miles. From various facts that have come up, it is evident that mating may occur two miles from the apiary, or about that, though, as a general rule, it will take place within half a mile, and generally a little remote from the apiary at least.

T. T. F., of Tennessee, asks how to have a queen fertilized by select drones. *Ans.*—The only way is to place perforated zinc over the entrances of the colonies having undesirable drones. For this purpose, drone-guards or Alley traps may be used. Drone comb should be given, and stimulative feeding should be practiced on the colony or colonies having select drones. Unless such bees are fed daily a small amount of sugar syrup when honey is not coming in, they will be liable to kill off the drones, or refuse altogether to rear them. The conditions of an ordinary honey-flow should be brought to bear upon the colony as nearly as possible.

H. T. G., of Florida, desires to divide, and give queens to the queenless halves of the divided colonies in the most economical and satisfactory way. He has had difficulty in rearing queens. *Ans.*—During the months of August and September, untested queens will be down quite low. In lots of a dozen they can probably be purchased for 60 or 65 cents apiece. These queens, while cheap in price, will, most of them, prove to be as profitable and serviceable as any; and it is certainly an advantage to buy queens occasionally, outside of your own locality. In this way an infusion of new blood will be secured. If our correspondent prefers to rear his own queens we would recommend to him any of the various methods in the text-books.

R. H. S., of Ohio, has several colonies in his apiaries that have only virgin queens, and asks whether it would be advisable to replace these, or whether, if left, they will be fertilized next spring. *Ans.*—Virgin queens left over during winter are sometimes fertilized the following spring; but the cases are rather rare; and in many of the instances when it was thought that such delayed mating took place, the queens were actually fertilized the previous fall; but as it was past the time for egg-laying, they passed for only virgin queens. Referring particularly to the question, we would recommend that the virgins be removed, and laying queens be inserted in their stead. The latter, at this time of year, can be bought for a trifling sum

H. H. G., of Florida, says that, after the honey season, he has great strong colonies. Desiring to increase, he wants to know the best way to divide them, and how to supply the queenless half with queens the most economically. *Ans.*—After having prepared new hives on separate stands, divide one of the colonies by putting two-thirds of the bees and all the *sealed* brood, with the queen, on the new stand. This will leave the *unsealed* brood on the old stand with one-third of the bees. Most of the bees on the new stand will return, giving the old stand, perhaps, in the end, the larger share. But as the new hive has all the hatching brood, young bees, and the old queen, it will very soon be equal in strength to the old one. After the old queen is removed, the old colony may rear cells from the unsealed brood; but it will be better to give them cells from some choice colony previously made queenless for the purpose. These cells should be eight or nine days old. If economy is not so much of an object, purchase some good untested queens of some reliable queen-breeder. In August they are as low as they will be—generally about 75 cents each.

J. K. C., of Louisiana, wishes to know whether it is possible to breed a queen whose workers shall be extra honey-gatherers, by doctoring or tinkering with the larva of said queen before she hatches. *Ans.*—Certainly not. This thing has been brought up several times before, and certain old-fogy bee-keepers have wisely said they had the secret of manipulation, which they said they would sell for a certain sum. Man can not step in and interfere in this fashion with the processes of nature. The only way to get extra honey-gatherers is to breed by selection—that is, by breeding from queens whose progeny excel others in the yard; and by this process, in time, a race of workers more energetic than the average might be secured. For some reason or other, but little attention has been paid to bees for business. The whole rage nowadays seems to be for *color*—five bands, etc. That is all right in its place; but we hope as much—nay, *more*—attention will be paid to bees for energy and longevity—in general, bees for business, because it is from these that come the dollars and cents. Extra color alone will not add another cent to the pocketbook, except—that of the queen-breeder, who breeds them just because his customers demand them.

W. H. C., of Michigan, asks, 1: "As I want to Italianize this season, I want to know whether it would be a good plan to introduce strange queens to colonies that have just sent out the first swarm, previously cutting queen-cells, or leave the new queen to tear them down." *Ans.*—We would always advise tearing down the queen-cells. It is true, that the queens to be introduced *may* do it; but you always run the danger of a young virgin hatching out, in which case the bees are liable to take up with their young mistress rather than with their old one, and, of course, the latter is killed. In introducing queens it is *always* safer to tear down the old cells, because, after bees get cells nicely started, they are inclined at times to lay their hopes on them so strong that, when a new queen is introduced, they carry out their original purpose, and the introduced mother is sacrificed. W. H. C. asks further: 2. Would this process prevent after-swarming? 3. If I order queens, and receive them before I need them, how may I keep them alive till I do need them? *Ans.*—2. To a certain extent. 3. You want to manage somehow so as not to receive queens before you want them. You can keep them in small nuc

however, as explained by Mrs. Atchley on page 740 of *Gleanings in Bee Culture* for May 15, 1894.

Wintering.

W. W. C., of the District of Columbia, asks whether, in warm spells in winter weather, bees will rear brood. *Ans.*—Yes, almost invariably—especially toward spring.

L. A. W., of Ohio, would like to know whether the outdoor-packed colonies should have full-width entrances. *Ans.*—Yes; and be sure they are kept clear of any dead bees that may lodge.

W. C. D., of Connecticut, desires to know whether sawdust would answer just as well for packing double-walled hives as chaff. *Ans.*—Sawdust will do just as well, we think, so far as protection is concerned. The only objection to its use is, that it is heavier than chaff.

S. S. S., of Wisconsin, asks, "If the weather is warm enough for the bees to fly during winter, would you take the packing from the top of the frames and give them all a chance for a cleansing flight, or let them alone?" *Ans.*—Let them alone, by all means. If you are sure the bees have stores the previous fall, do not tinker with them till next spring.

W. E. D., of Virginia, wants to know whether the cover should be put on the hive again after putting the chaff cushion in. *Ans.*—Why, friend D., what reason should there be for leaving it off? Of course, you want to put it on, otherwise the cushion would become soaked from rains, and thus defeat the very object of the cushion—namely, making a non-conductor to the cold.

I. C. L., of Pennsylvania, has a considerable quantity of honey-dew in his combs, and wishes to know whether it would be safe to give it to his bees for winter. *Ans.*—We would risk it, because the majority of the reports show that bees have wintered successfully on such inferior stores. Of course, it is safer to give the bees sealed clover or basswood honey, or, better still, sugar syrup that has been fed in the early fall.

C. & C., of North Carolina, write that they left their supplies on the hives during winter because they feared that, if they took off the supers, the bees would not have enough to winter on. They ask if they should be removed next spring. *Ans.*—Yes; otherwise the bees will soil the sections; and, besides, the bood-nest should be reduced to the smallest capacity during the brooding season, so as to conserve the warmth.

E. W. S., of Alabama, asks how long burlap covers shall be kept on under cushions for outdoor wintering. *Ans.*—We usually make it a practice to keep the burlap covers on until settled warm weather, say about the middle of May with us. Sometimes we leave them on until the first of June. It is not advisable to change the burlap to enamel cloth very early in the season; in fact, we do not use enamel cloth at all nowadays with the Dovetail hive.

S. W. S., of Indiana, says his bees are spotting up the hives pretty badly; bees seem to be weak, and he is inclined to believe they are affected with what is called dysentery. He desires to know what to do. *Ans.*—No doubt the bees have the regular dysentery. The only thing to do is to let them alone. If you unite a lot of these weak bees they will all die just the same. The only cure we know of is good warm weather. The entrances must be contracted pretty close to prevent robbers from utterly annihilating them.

J. M. C., of New York, writes that his bees in the cellar are flying out of their hives, and dying on the cellar bottom. *Ans.*—Perhaps your cellar is too warm. In this case, give ventilation but not light. We should not, however, worry over them. They are generally bees that are too old or diseased to stay in the hive. For the health of the occupants above the room, as well as for the bees, we would keep the floor swept up. Do not be alarmed if you take out half a peck of bees at a time in a cellar containing 25 or 30 colonies.

M. A. B., of Pennsylvania, has a large family of small children that play and romp on a floor under which is a cellar containing some 35 or 40 colonies of bees. He would like to know whether the general noise and disturbance will do any harm. *Ans.*—In scores of instances of this kind we do not remember to have seen any reports showing bad results following from such disturbance above. We have wintered bees in a cellar for three winters, under the living-room; and while they were in the cellar we have not discovered that romping or walking, on the part of children or adults, did any harm.

M. J. R., of Minnesota, writes that the snow has piled up around the entrances of his hives, and he inquires whether there is danger of the bees smothering by leaving them so. *Ans.*—If the snow is light and not soggy, we would let it be. A general thaw, followed by a freeze, may close up some of the entrances, and it is possible that it should be cleared away. But ordinarily, if the colonies have absorbents such as big chaff cushions over the frames, we would let them alone. They will get enough air through the cushion; so we think there will be no danger of their smothering.

F. C. F., of Wisconsin, is rather hard up for money this year, and can not afford winter cases or chaff hives. He has a wet cellar, and also a garret. Where would it be best to put the bees? *Ans.*—A garret is a poor place at best. We have known of scarcely any good results in wintering bees in such a place. We would risk a damp cellar. But, friend F., for the health of your family, if not for the health of your bees, drain that cellar out as soon as possible. If the bees do not have dysentery, your children may have typhoid fever, diphtheria, and all the other bad ailments resulting from a wet cellar.

E. N. R., of Michigan, asks what sort of packing material we recommend, and whether it would pay to send out into the country when he has planer-shavings or forest-leaves in abundance on hand. *Ans.*—After experimenting with the various packing materials, we can discover but very little difference in favor of any of them. We have wintered bees as well under planer-shavings as under the best wheat chaff. Chaff has the preference for cushions because it is lighter, and is more available for the average farmer. Where forest-leaves are used, the packing should be made thicker, and pressed down so as to be more compact.

N. E. J., of Ohio, says his bees are flying out upon the snow, and dying by the hundreds, on warm bright days. He desires to know the cause, and how the trouble can be stopped. *Ans.*—Bright sunshine will, many times, call out the old and diseased bees. It may also draw out a few others. But generally we consider that these old bees might just as well be out of the colony as not; and if they are to die soon they had better die with their carcasses outside. But even if some young bees do fly out with the rest, the loss is generally so small as to be hardly worth considering. A bee here and there means a very small number from individual colonies in a large apiary.

C. F. F., of Minnesota, wishes to know whether we would advise him to winter his bees in the cellar, or outdoors in double-walled chaff hives. *Ans.*—In the very coldest climates, or, at least, where the winters are severe, and the temperature runs for several weeks below zero, cellar wintering seems to prevail. Whether this is because bees can best be wintered that way or not, we can not say; but it is usually safer to follow the prevailing custom. Indeed, some bee-keepers say it is impossible for them to winter on summer stands, even when packed in hives of the most improved pattern. On the other hand, there are some bee-keepers—for instance, E. Sturgeon, of Kincardine, Ont., Can.—who can not winter indoors, but always have success in outdoor packing. For the latitude of Northern Ohio, the outdoor method generally gives the best result—that is, the beginner seems to succeed better.

P. W., of Pennsylvania, asks: "What is the best covering on top of the brood-frames for wintering colonies outdoors in double-walled hives?" *Ans.*—We always make it a practice to remove the enamel cloth (if in a chaff hive) and put on top in its place a sheet of burlap. Any old carpet or old cloth that has not been waxed or smeared up with propolis would do just as well. On this put the chaff cushion, but be sure there is a passageway over the combs, under the burlap. We use Hill devices; but many others use, with equally good results, sticks or corncobs across the frames. P. W. asks, again, how it would work to place on top of a strong colony, in the spring, to get increase, another hive filled with foundation; after the queen was laying above, to lift the top hive off, and set it on the old stand, and take the old one and put it on a new stand a few feet away. *Ans.*—This would work all right providing your colony is extra strong. But usually, in the

spring, such a plan would only be working mischief. You would have a lot of weak spindling colonies that would be practically good for nothing at the time of the honey-flow. It is better to secure all the increase possible inside of the original parent colony.

Miscellaneous.

M. C. D., of Connecticut, asks if black bees work on alsike clover to any extent. *Ans.*—Yes, as well as any bees, though they are not so good for working on red clover as are the Italians.

W. E. D., of West Virginia, asks whether we use chaff hives summer and winter. *Ans.*—We do; but at the approach of warm weather we remove the chaff cushions—otherwise the colonies are protected the same as in winter.

P. J. W., of New York, asks if drones are ever raised in worker comb. *Ans.*—Yes, very frequently, particularly if there is no drone comb available. Drones from fertile workers or drone-laying queens are raised, as a general thing, in worker-cells.

H. G. S., of New York, wishes to know whether it is advisable to crowd a ten-frame colony on to six frames. *Ans.*—If the colony is good and strong, we would not reduce the ten-frame brood-nest to less than eight frames, nor an eight-frame to less than six.

C. M. McC., of West Virginia, would like to know what to do with old moldy combs. *Ans.*—Put them in or over a strong colony of bees. They will clean them up and make them sweet in short order. If moldy and worm-eaten, throw them into the solar wax-extractor. If moldy and crooked, put them in the same place. It does not pay to fuss with any thing but straight first-class combs.

R. A. M., of Illinois, wishes to move his bees a distance of five miles, and would like to do it during the winter months. *Ans.*—It is usually desirable to move bees in the spring, about the time they will begin to fly. But it can be done during mid-winter; but we would select a day when the sun is shining, when the temperature is above freezing, else the combs will be more liable to break, and disturbance to the bees be more serious.

D. S. J., of Colorado, asks how many pounds of honey there are in one of beeswax. *Ans.*—It varies in different localities, and during different seasons of the year. If I remember correctly, half an ounce of comb, on the average, will hold a pound of honey. When this comb is made from foundation, the weight is increased according to the weight of the foundation used, because the bees, it seems, do not do very much thinning-down of the septum.

T. V. B., of Ohio, desires to move to a location where bees may be kept with the greatest profit. *Ans.*—California, Arizona, New Mexico, and Colorado are good bee-countries; but as a general thing we would not advise any one to move if he has any other business he can tie to in connection with bee-keeping where he now is. Bee-keeping is a success or a failure in nearly every State in the Union. A great deal depends upon the man.

A. B. S., of Ohio, wants to know if there is any law to protect bees from being trapped and scalded, or poisoned. *Ans.*—A case of this kind came up some time ago; and, if we remember correctly, the destroyer of the bees was compelled to pay damages. A good deal hinges on the point as to whether the bees in the first place were trespassing—that is, robbing from broken fruit. This is one of the nice questions, and should be submitted to competent legal authority.

J. W. B., of Virginia, writes: "I have some bees; I do not know what they are. They are very small. Some of them are as black as coal, and some have one yellow band." *Ans.*—There seem to be two varieties of black bees in this country—one a sort of brownish bee, of good fair size, and another that is coal-black and smaller. The bees you have are undoubtedly of the latter kind, with a very little Italian blood mixed in, or what we should call very dark hybrids.

H. A. E., of North Carolina, referring to the sure way of introducing valuable queens, mentioned in this book, by giving said queens to hatching brood, wants to know how long the hive should be kept closed up. *Ans.*—If brood is hatching readily, there will be young bees enough to care for the queen in a few hours. But the hives should not be closed air-tight. A wire screen should be placed over the entrance, so as to allow of a little ventilation. In two or three days the young bees will be old enough to defend the entrance.

W. E. F., of Virginia, would like to know how to prevent bees from mixing. *Ans.*—We do not understand exactly what is meant by this question. If W. E. F. means that he wants to know how to prevent queens from mating with inferior or other drones we would say, put on drone-traps or entrance-guards to all entrances of hives containing undesirable drones. As to the mixing that takes place from entrance to entrance of hives that are situated close together—*bees* going from one hive to another—that will make no serious trouble.

H. C. M., of Illinois, would like to know whether it makes any difference whether a honey-house be made of brick or not. *Ans.*—Brick would be considerably more expensive, and we doubt whether it would be as good. While brick *dwellings* do very nicely because artificial heat is used inside, they would be poor places for the storage of honey without that artificial heat. He asks further as to the advisability of putting honey into empty molasses barrels or kegs. *Ans.*—There would be no objection, providing such receptacles were washed out with hot water.

C. E. P., of Colorado, wants to know why bees will cluster on the outside of the hive. *Ans.*—The clustering on the outside is usually caused by too hot weather or an entrance that is too small, or both. Of course, it is assumed that they would not thus cluster out were it not for the hot weather; and, the entrance being small, they are unable to keep the hive sufficiently cool by fanning. You can smoke the bees into the hives again, but they will come out. If the hive is too small, give them more room by means of an extra super, and see that the whole hive is properly shaded.

D. J. P., of New Mexico, having purchased an Alley trap, says the drones, as soon as trapped, die very fast in it, and wishes to know if this is as it ought to be. *Ans.*—Yes. The drones will not live more than a few hours after being trapped, according to our experience. They will worry themselves trying to pass the metal, or, what is probably true, starve to death. The trap is generally used for excluding undesirable drones; and if undesirable, their early demise is not much to be regretted. If desiring to capture select drones for an out-yard, they should be fed and taken care of at once.

W. U. R., of Florida, asks us what we prefer for shading bees—trees or a shed. *Ans.*—In hot climates, especially in Jamaica, long low sheds are used. In the North, we prefer trees. But experience has proven that bees that have direct sunshine during the early part of the spring build up quicker in the North than when under some sort of shade. As a general thing, on account of the very hot weather that is usual in most of the Northern States, we prefer to have the bees in the shade. They are less liable to lie out at the entrance, and loaf; and it is much more comfortable to the apiarist to work in the shade.

W. L. M., of Ohio, has 20 colonies of bees to move a distance of 20 miles, and wants to know when it would be the best time to do it; and would we advise him to do it at night? *Ans.*—You can move them at any time after settled weather. If the weather is not too hot you can make it do as well or better in the day time. Make sure that your frames are secured, and that the bees have plenty of ventilation. Wire cloth over an ordinary entrance, if the colony is not too strong, or weather hot, will afford sufficient ventilation; otherwise, remove the top and tack mosquito-netting or wire cloth over it. If the day is frosty, ventilation at the entrance may be sufficient.

P. S. L., of New York, wants to know how to make vinegar of honey. *Ans.*—It takes two pounds of honey to made a gallon of vinegar, and from one to two years' time. Use, as a general thing, only refuse honey—such as can not be used for any other purpose. Put water enough into the honey so it will just float an egg, and allow the sweetened product to stand in a barrel with one head out, under shelter. Cover the barrel with a piece of cheese-cloth, to keep out the dirt and flies. This sweetened water will soon begin to "work," and occasionally the scum should be taken off with a skimmer until nothing rises. It will take anywhere from a year to two years to make good vinegar. But honey vinegar is not profitable unless old refuse is used.

ANSWERS TO QUESTIONS FROM BEGINNERS.

J. M. G., of Pennsylvania, says he has one of our eight-frame hives, but does not know what the division-board is for. *Ans.*—With spaced (or, rather, self-spacing) frames, it is best to have a division-board so the frames can be removed without rolling over and killing bees. After removing the division-board, space over, from the middle, three or four frames close up to the hive. This can be done at one operation providing Hoffman frames are used; you will then have plenty of room to pull out the frame you desire to examine. The division-board is also a convenience in reducing the hive capacity when the colony occupies less than the regulation eight frames.

J. M. S., of Indiana, wants to know what is a good remedy to keep ants from hives. *Ans.*—Find the nest if possible, and pour about half a pint of coal oil on it. A better way (according to Prof. Cook) is, to buy an ounce or two of bisulphide of carbon at the drugstore. With a crowbar make a hole right in the center of the nest. Pour in the bisulphide, and close the hole by tamping around the edges. That will be the end of those ants. Ants do no particular harm in the hives here in the North, although they do considerable mischief in the South. Be sure you keep all fire away from the bisulphide, as it ignites at quite a distance from fire, even a lighted cigar, and explodes with terrific violence.

J. R. S., of Indiana, has a weak colony, and he inquires how to strengthen it up for the coming summer. *Ans.*—Contract their brood-nest to as small a space or to as few combs as they can possibly cover, having made sure that they have plenty of stores. When the weather is warm enough so they fly a little every day, give them a little stimulative feeding, with half a pint of warm sugar syrup. Such weak stocks, however, should be, if not already, put into double-walled hives with some good soft warm packing around them. For that matter, this will apply equally well to strong colonies, for no stocks do as well in the single-walled hives in early spring as those having adequate protection.

J. L. A., of Kentucky, inquires whether it ever gets so hot that the bees can not make comb. *Ans.*—If the hive is painted a dark color, and is not sheltered in some way from the direct rays of the sun, it may be so hot that the bees would refuse to build comb, or, in fact, do any thing else. Indeed, there are times when the inside of the hive becomes so hot that the combs melt down, and then, of course, nothing can go on decently and in order. As a general thing, however, bees can keep the hive cool by means of the currents they make with their wings; and it is only when they can not do this that the combs melt down. We must not expect our bees to accomplish too much. Give them a little assistance in the way of a shade.

C. N. W., of New York, asks why the bees uncap sealed brood. *Ans.*—The brood may have been overheated or chilled at some time, or possibly moth-worms may be making their way unobserved by you under the cappings. Any or all of these causes may result in the bees uncapping the brood. He also asks why the bees sometimes come tumbling out of the hive in lots of two or three, clinging together by the feet, and, after struggling a while, free themselves. This is evidently a case of a robber or two getting past the sentinels at the entrance, and, finally, being discovered by the workers farther in the hive, they are grabbed. A struggle immediately follows, in which more of the bees grab the robber; and the result is, they come tumbling out of the hive as stated, but, as a general thing, the robber frees itself

J. W. D., of New York, asks: 1. What is the legal distance for a hive of bees to stand from a street or highway? 2. How close can the bee-entrances be for a house-apiary, considering the welfare of the bees, and economy of space inside the house? 3. Toward what point of the compass is it best for the entrances to face? 4. Will a wall of inch boards, two thicknesses, with paper between, be any injury to the bees in summer? *Ans.*—In most States there is probably no legal distance. However, there may be a municipal ordinance regulating the distance of bees from the highway 2. Generally not closer than two feet. 3. Toward the east or south. 4. No. Better make a space between the walls, and pack with sawdust.

F. M. M., of Arkansas, desires to move 80 colonies in Dovetailed hives to Southern Ohio. *Ans.*—We would fasten the bottom-boards and close up the entrances. We would then, in place of the covers, tack on rims, made out of ⅞ stuff, of the same width and length as the hive, outside measure, and 2 inches deep. These rims should be covered with wire cloth or cheese-capping. If you are going to move your household effects also to Ohio, you had better put the hives in one end of the car, and your goods in the other end; it will be safer for you to accompany the car, as the jostling and bumping will disarrange the hives. To partially remove the jar, it is a good plan to strew the bottom of the car, where the hives are to be placed, with four or five inches of straw. We omitted to say any thing about fastening the frames, for we assume that your bees are on the Hoffman frames, which require no fastening. If not, we would use the spacing-sticks illustrated in our catalog.

C. & C., of North Carolina, inquire whether we would recommend putting supers on new swarms the first season; also, whether a starter should be put in the bottom of the section as well as at the top. Their bees are in old box hives, because they do not believe they are equal to the task of transferring. *Ans.*—If you are speaking of first swarms, or swarms that are strong, we would say, put the supers on, providing honey seems to be coming in. Starters—that is, narrow ones—may with advantage be fastened to the bottom of the sections as well as at the top. Dr. Miller uses a wide starter at the top, letting it hang down two-thirds of the way. He also fastens a narrow one at the bottom. In this way he finds that the bees, in drawing out the comb, leave a good attachment at both top and bottom—the upper starter, as it were, growing into and uniting with the lower one. As to the difficulty of transferring, that is a small matter providing you follow the Heddon short method. See TRANSFERRING.

D. G., of Nebraska, has quite a number of colonies that had foul brood last fall, and asks, 1, whether the honey in the foul-broody hive would be fit to eat, without extracting and heating; and, 2, whether, after boiling, it would do to feed to bees with safety; and, 3, is there any way of disinfecting the hives so that they may be used with perfect safety? *Ans.*—1. Such honey would taste all right; but we would not advise you to make any use of it, for bees will very often make their way into the house; and if one of them should *happen* to get a sip of this infected honey it would carry the disease to its colony, and thus spread it all over the apiary again. 2. Yes. 3. Hives may be cleansed by immersing in boiling water, as directed under FOUL BROOD. It is also *possible* that they may be disinfected by the use of carbolic acid reduced 50 times, the same painted on the inside and outside of the hive. That is the way we painted our house-apiary before putting any more bees in it.

F. F. C., of Michigan, asks when is the best time to double up to get the most surplus. He does not wish to keep over 25 colonies, and these he would increase every summer to 50, uniting down to 25 again for the fall flow. *Ans.*—I hardly know how to answer this question. Better keep down increase in the first place. If you *must* unite, I suppose you will have to do it just before the honey-flow; but, dear me! you will make them swarm fearfully if it is any thing of a honey-flow and you are running for comb honey. Of course, a good deal depends upon the size of your hive, and whether you will produce comb or extracted honey. The usual practice is, to let the bees alone, so far as uniting is concerned, until along toward fall—that is, providing the colonies are normal. If they are only half strength, of course it pays to unite in summer, providing you can do it without too much loss of bees, and this surely would be one trouble just before the honey-flow. Uniting can not usually be practiced satisfactorily except in the fall, when the days are too cool for the bees to fly much.

C. C. & S., with several others, say that their bees seem to be suffering from fits; that they come out and flop and crawl around, and finally collapse; that they have a sort of tremulous motion to their wings, the bees themselves having a swollen and greasy appearance. *Ans.*—This is what is called "bee-paralysis"—a disease that is getting to be quite common, although it has never proven to be any thing serious except on one or two occasions, and is generally confined to two or three colonies. We have, in the past, recommended removing the queen and introducing another; but reports show that this does not always work. Some recommend giving the bees a fine spray of slightly salted water, the spray being scattered over the combs and bees.

Some insist that this always cures, while others say it has no effect. As the disease sometimes disappears of itself, we are obliged to confess that we know of no remedy that can be surely relied upon, although, if we had diseased colonies, we would administer the salted spray. Fuller particulars will be found under the head of DISEASES OF BEES.

S. A. S., of New Hampshire, is bothered with an excess of drones and drone comb, and asks for a remedy. *Ans.*—Use foundation in full sheets for the brood-nest, and cut out or dispose of all your drone comb. Very few drones will be reared from a normal queen if nothing but worker comb is given the bees.

J. L. L., of Kansas, would like to know whether the drones of a pure Italian queen are all yellow, or whether there is an occasional one with a black band. *Ans.*—Drones of a queen producing the ordinary normal three-banded Italians are rather dark-colored, with a very little yellow. There is usually not so much yellow showing on them as on the workers from the same queen. Drones from the so-called five-banded Italian stock, in some instances, are nearly all yellow.

D. E. E., of Arizona, says he has a colony that reared a queen, and, after she had been laying in the hive nicely for seven days, the bees balled and killed her. He says that there was no robbing going on at this time, and that the bees were gathering alfalfa honey. He asks why the bees killed her. *Ans.*—There was probably something wrong with the queen. The bees can sometimes detect weaknesses or undesirable qualities in the queen sooner than the apiarist. If robbing had been going on we might surmise that a few of the outsiders were at the bottom of the trouble.

E. J. O., of Ohio, asks how many bees it will take to gather a pound of honey per day. *Ans.*—It all depends upon the source from which honey is coming—that is, the amount of flow. From basswood, yielding at its best, a single colony will gather from 3 to 30 lbs. of nectar per day—probably 3 to 7 would be a fair average. A good fair working colony—that is, the bees themselves—weighs from 5 to 8 lbs; and as we know from careful experiment that there are about 4500 bees in a pound, there will be anywhere from 20,000 to 40,000 bees. This number should be reduced anywhere from a third to a half, so as to include only the working force, or that force that brings in the honey. We may assume, then, that it takes, on this basis, anywhere from 15,000 to 25,000 field-bees to gather 3 to 5 lbs. of nectar from basswood; or, to get right down to your question, 5000 bees all day will gather a pound of nectar, and that "all day" may mean 12 or 14 hours. From clover the bees will be able to gather less than half as much per day. Mr. E. E. Hasty figures that from 3500 to 7000 bees can carry a single pound of nectar. Averaging the number at 5000 it would seem that either there is a less number of working bees or else they make only a few trips to the fields. During basswood, bees are generally loaded down.

B. C. S., of Arkansas, has a lot of bees on a farm 18 miles distant, and he desires to know whether he can, at this season of the year (June), bring them home safely; and if so, how. *Ans.*—We would avoid moving bees in the height of a honey-flow; and under no circumstances would we do so then unless we were sure that the bees would get more honey in another location. If the weather is warm, or what may be termed "hot," with the mercury running up to, say, 90° in the shade, we should prefer to fix up the bees about three o'clock in the afternoon. We would fasten the frames, if they are loose or the old-fashioned kind; tack wire cloth over the entrances, and fasten some of it over the top. During hot weather, bees should not have any regular hive-cover on while being moved. If a colony should be a very strong one (and such is pretty apt to be the case), the bees should be put into two hives or else have an empty upper story, with wire-cloth cover. As soon as the bees have quit flying, load them on the wagon and bring them home by moonlight, if you can select such a night in the month. As soon as you arrive home, place the hives on their permanent stands and remove the wire cloth from the entrances, so that if, in any case, the bees should be suffering from want of air, they can be relieved.

W. E. A., of West Virginia, wants to know if it is a good plan for a beginner to open his hives every day or two to examine the brood-comb. *Ans.*—An enthusiast will probably do this whether it is advisable or not. It might and it might not do harm. During a honey-flow, however, we would not disturb them unnecessarily. Every little interruption prevents just so many tiny drops of honey from coming in in the regular way. W. E. A. also asks what to do when all the brood-combs get full of honey in the midst of a full flow of honey, so that the bees make combs all over the tops of the frame, even when they have section boxes in the super. *Ans.*—If the flow of honey continues, the bees ought to go above; but sometimes they get quite content with what is already stored in the brood-nest, and then you must set them at work in some way if possible. If you have other colonies that are started in sections, remove two of the sections with comb partly drawn out, and filled with honey, from one of the supers where the bees are working, and place it in the super where the bees seem disinclined to go. Give the bees plenty of shade; and if they then fail to go above, we should be tempted to clip the queen's head, and introduce one of a strain whose bees go into sections readily.

G. P. B., of Arkansas, asks the following questions: 1. Is it ever necessary to extract from the brood-chamber to give the queen room to lay? 2. Will bees winter on buckwheat honey entirely, and rear healthy brood in the spring? 3. Is sorghum syrup a good feed for bees? 4. Will a populous colony store honey without a queen or brood? *Ans.*—1. Not generally, but sometimes it may be advisable. A better way is, to take out the combs of honey entirely, store them away for winter feeding or some future extracting, and put empty combs or frames of foundation in their places. 2. Yes, generally. Buckwheat honey was once considered unwholesome for bees; and while it is generally admitted that it is not as good as white honey, or, better still, sugar syrup, as a general rule the bees will go through on it in good shape. 3. In the South, sorghum syrup may answer; but as a general thing bee-keepers in the North prefer something else for a winter feed. 4. Yes; but bees usually have more vim when they have a good thrifty queen with them; but in order to prevent swarming, some bee-keepers remove the queen entirely during the height of the honey-flow—first, to prevent swarming; and, secondarily, to prevent the raising of a lot of bees that, later on, will be consumers. These bee-keepers are reported to get pretty good crops of honey.

O. B. K., of Maine, is greatly troubled with robbing. He has about thirty colonies, and has lost five already. What is he to do? *Ans.*—First, study up on the subject of robbing, as given in this book or any standard work. But I may suggest right here that there are a few important things to be observed. See that the hive-covers fit tightly; that the hives are well made, and the joints tight-fitting—or, at least, bee-proof. After the honey season, if the colony is not of normal strength the entrance should be contracted. It should be contracted any way if robbing is progressing. If the bees get started badly on a colony, close the entrance nearly tight with grass. After a while, when robbing has quieted down, the grass will have wilted away and fallen out of the entrance. It is usually best not to close the entrance up entirely with blocks of wood. Even if you do not forget to take them away after robbing has quieted down, the bees are liable to smother. If you are careless about letting the bees help themselves to your honey-tank, you will have robbing all the season. Every thing containing honey should be made absolutely bee-proof. When you see bees buzzing around, and increasing in numbers around a can of honey or case of comb honey, do not be too sure that they can not get at it. If they continue to buzz around, you may rest assured that they are getting honey; and the only way to stop them is to find the place where they are getting in.

GLOSSARY.

Abdomen of Bee.—The terminal division of the insect, composed of a variable number of rings.

Absconding Swarm. — One that, from any cause, leaves its hive and starts for parts unknown, either without first clustering or because neglected when clustered.

After-Swarms.—Those issuing after the first swarm.

Alighting-Board.—A board in front of the entrance to a hive, on which the bees alight.

Apiarian. — An adjective; of or relating to bees. Often incorrectly applied to one who keeps bees.

Apiarist.—One who keeps bees.

Apiary.—A spot of ground where bees, hives, and all the paraphernalia are kept; also a number of colonies kept in one place.

Apiculture.—The culture of bees.

Apidæ (Latin.)—Family to which bees belong.

Apis (Latin).—The genus to which bees belong.

Aphis, pl. ***Aphides.***—A genus of plant-louse that emits a liquid sometimes gathered by bees, and called honey-dew. (See Aphides.)

Artificial Fertilization.—Impregnation of queens in confinement, or by mechanical means.

Artificial Heat.—Warmth artificially produced, and applied to bees.

Artificial Pasturage.—Plants and trees cultivated for the honey they yield.

Artificial Pollen.—Rye meal or other substances fed to bees as a substitute for natural pollen.

Artificial Swarm.—A colony made by the division of one colony.

Balling.—The manner in which bees cluster about a queen, in attempting to sting her.

Bee-Bread.—See Pollen.

Bee Culture.—The care of bees.

Bee-Dress.—Suit adapted to prevent stinging by bees.

Bee-Escape.—A device for getting bees out of supers. See Comb Honey in the body of the work.

Bee-Gum.—Term applied to that part of a tree or log which is, or has been, occupied by wild bees. Applied, by our friends in the South, to all kinds of bee-hives.

Bee-Hive.—A box, or other receptacle, made by man, to be used as a home for the honey-bee, and usually containing but one colony. (See Bee-Gum and Skep.)

Bee-House.—A house for bee-hives. Also applied to the rude sheds seen about the country, where one or more hives are crowded together.

Bee-Line.—The most direct route between two places.

Bee-Moth.—A gray miller, ¾ inch long, the larvæ of which feed upon and destroy combs.

Bee-Paralysis.—A disease affecting adult bees. (See Diseases of Bees, in the body of the work.)

Bee-Plants.—Plants which are valuable as honey-producers.

Bee-Space.—"A space that will admit of the passage of a bee," and "in which bees are least apt to build burr-combs." It is a scant ¼ of an inch.

Beeswax.—See Wax.

Bee-Tree.—A tree occupied by a swarm of bees.

Black Bees.—A variety of the species *Apis mellifica*, whose color varies from dark brown to black. They are natives of Germany.

Black Brood.—A malignant contagious disease. (See Foul Brood, in the body of the work.)

Bottom-Board.—The floor of a hive.

Box Hive.—See Hives; also Box Hives, in the body

Box Honey.—Honey stored in old-fashioned glass boxes.

Brace-Combs. — Often incorrectly called "burr-combs." Spurs of wax, built between brood-frames during the honey-season.

Brimstoning.—Fumigating with sulphur. See Fumigate, and Taking up Bees.

Broad Frame.—A frame used for holding section boxes—now generally called "wide frame."

Brood.—When applied to bee culture, larvæ in all stages. Not applied to bees after emerging from the cell, however young they may be.

Brood-Comb.—Either worker or drone comb used for breeding; usually applied to worker-comb.

Brood-Nest.—The space inside the hive, occupied by eggs and brood, extending in all directions from the center.

Brood-Rearing.—Raising bees.

Brushed or "Shook" Swarms.—A forced artificial swarm, or a colony that has been shaken or brushed off its combs in front of the entrance, compelling the bees to run in on a new set of frames containing foundation. Such bees are not liable to swarm. See Brushed Swarms, under Swarming, in the text.

Bumble-Bee, or *Humble-Bee.*—A large noisy insect; a species of the genus *Bombus*.

Burr-Combs. Bits or spurs of wax built on the top of thin top-bars. See Thick-top Frames, under Hive-Making.

Candied Honey.—Honey that has solidified. (See Candied Honey, in the body of the work.)

Capped Brood.—Brood with a thin film of wax covering the cell.

Capped Honey.—Honey in cells that are sealed with wax.

Cappings or Caps.—The covering of brood or honey in cells.

Carniolans.—A race of black bees from the region of Carniola, Austria. Though much resembling the black bees, they are perhaps a little larger, and are said to be very gentle. (See Bees, in the body of the work.)

Cell.—A hexagonal depository for honey, and apartment for brood-rearing, made by honey-bees, of wax; two sizes. See Honey-Comb, and Wax.

Cell-Cups.—Artificial cups from which queen-cells are developed.

Chaff Hive.—A hive having double walls filled with chaff at all seasons.

Chyle Food.—See Royal Jelly.

Chrysalis.—State of brood in transition from larva to a fully developed bee. Termed, also, pupa and nymph.

Climbers.—Apparatus to assist one in climbing trees.

Closed-End Frame.—See Fixed Frames, in the body of the work.

Clustering.—Manner in which numbers of bees cling together.

Colony.—A stock of bees, consisting principally of worker-bees; but which has, when perfect, one queen and sometimes a number of drones.

Comb.—See Honey.

Comb-Basket.—A tin receptacle, with handles and a close-fitting cover, for containing combs, or carrying them from place to place.

Comb Foundation.—Thin sheets of wax, which have been passed between the two rollers of a foundation-machine, or formed in a foundation-press, having the shape of the bottoms of cells, with their edges partially raised. An artificial foundation, or partition, upon which bees build comb.

Comb-Foundation Machine.—A machine consisting principally of two metallic rollers engraved with such accuracy that thin sheets of wax passed between them will have the form of the bottoms of cells. Also a press for the same purpose.
Comb-Guide.—Pieces of wood used as guides for building combs in brood-frames or surplus boxes.
Comb Honey.—Honey which has not been removed from the comb; i. e., honey in its natural state.
Cushion.—A case or bag filled with some soft and loose porous substance, as chaff, for covering brood-frames on top or side.
Cyprian Bee.—A native of the island of Cyprus.

Decoy Hive.—One placed in position to attract and catch passing swarms.
of the work.
De-queen.—See Unqueen.
Dividing.—Separating a colony into two or more, by removal of combs or bees, or both.
Division-Board.—A board, of the same length and height as the inside of hive, used for contracting the size of the apartment.
Drone.—A male bee, larger than the worker. Useful for nothing except filling the sexual office.
Drone Brood.—Brood in drone-cells (see Cell), from which drones are hatched.
Drone Egg.—One that is unimpregnated, laid by a virgin queen, or fertile queen, or laying worker.
Drumming Bees.—Driving from hive, by pounding on the outside.
Dysentery.—A disastrous disease affecting bees in the spring; a diarrhœa.
Dzierzon Theory (pronounced Tseer'-tsone).—The theory of Dzierzon, formulated into 13 propositions, treating mainly of queens, their virginity, fecundation, and fertility.

Embryo.—The rudiments of existence of any plant or animal.
Entrance.—An opening in the hive for the passage of bees.
Entrance-Blocks.—Three-cornered pieces of board, for regulating the size of the entrance.
Egyptian Bee.—If it differs from the Italian, it is in being lighter colored, and exceedingly cross.
Extracted Honey.—Honey taken from the comb by means of an extractor.
Extractor.—See Honey-extractor and Wax-extractor.

Fdn.—Abbreviation for comb foundation.
Feces.—Excreta from bees.
Feeders.—Arrangements for feeding bees.
Fence.—A slatted separator having transverse cleats on both sides to form the beeways to plain sections. See Comb Honey.
Fertile.—Productive, laying; as, fertile queen or worker.
Fixed Frame.—See Fixed Frames, in the body of the work.
Foul Brood.—A malignant, contagious disease. (See Foul Brood, in the body of the work.)
Foundation. See Comb Foundation.
Frame. A movable structure of slats, generally four-cornered, in which bees build comb which may, by this device, be changed about inside, or removed from, the hive at pleasure. It was brought into use by Rev. L. L. Langstroth, in 1851. See cut, and Hives.
Fumigate.—To expose to smoke; to apply the fumes of sulphur or other substance.

Glucose.—See Grape Sugar.
Go-Backs.—Unfinished sections that are returned to the hive to be filled out. (See Comb Honey, in the body of the book.)
Grafting Cells.—A process of exchanging larvæ in a queen-cell for the purpose of raising queens from a choice queen. See Queen-Rearing in the body of this work.
Granulated Honey.—Honey that has formed into grains, in passing from a viscous to a candied state.
Grafted Cells.—Queen-cells from which larva of an undesirable queen has been replaced by a larva from a choice or breeding queen.
Grape Sugar.—A saccharine substance less sweet and less soluble than cane sugar, made principally from Indian corn; is called Grape Sugar because it is identical with the sugar found in grapes. It is often confounded with glucose, with which it is nearly identical, but glucose contains more dextrine than grape sugar, which renders it a permanent liquid, grape sugar being a permanent solid. Both substances are well known in commerce, and while glucose may, by chemical means, be converted into grape sugar, grape sugar can not, by any means known at present, be converted into glucose. The sweet principle of both substances is known under the general term of grape sugar, to distinguish it from cane sugar, and as the manufacture of these articles, as an important industry, is of rather recent date, our dictionaries and cyclopædias, so far as I can learn, have failed to make any distinction between the two.
Green Honey.—See Unripe Honey.

Hatching Brood.—Brood just emerging from cells.
Hive.—A box or receptacle for the habitation of a colony of bees. See Hive-making.
Holy-Land Bees.—A race of bees from the Holy Land. They are very prolific, and are good honey-gatherers. As they are so very vindictive, and are no better honey-gatherers than the Italians, they have not come into very general favor.
Honey.—The nectar gathered by bees from flowers, and brought to a viscous state by evaporation inside the hive, after being deposited in the cells.
Honey-Bag, or Honey-Sac.—An enlargement of the gullet, or first stomach, in which the bee carries the nectar gathered from flowers.
Honey-Bee.—An insect of the species *Apis mellifica*.
Honey-Board.—An arrangement for separating the brood-chamber from the surplus-apartment. It may be one plain board, or a series of slats, making a honey-board large enough to cover the whole hive or brood-nest. Its object is to prevent the bees from gumming together the upper and lower stories with brace-combs. It should have a bee-space above and a bee-space below. See Bee-Space; see also Honey-Boards, under the head of Comb Honey, in the body of the work.
Honey-Box.—A receptacle for surplus honey, closed on all sides, but with entrance holes for bees; mostly discarded now for the section boxes.
Honey-Comb.—A sheet of hexagonal cells, the same on both sides, having a middle wall, or partition. When new, weighs $\frac{1}{4}$ lb. per sq. ft., requiring for its production from 1 to 5 lbs. of honey. Brood-combs are $\frac{7}{8}$ to 1 in. thick; but, owing to the shape of the bottoms, each cell has a depth a little greater than half the thickness of the comb. Combs of this thickness will hold 3 lbs. of honey per sq. ft.; but the cells may be lengthened to the capacity of 10 lbs. per sq. ft. Worker-comb contains 28 cells per sq. in., on each side; drone-comb, 16 cells per sq. in., on each side: cells of both are of the same depth. Sides and bottoms of cells are, when new, 2-1000 in. thick. The bottom of each cell is formed of 3 rhombs, so united as to make the center of each cell the lowest part, which point is the uniting-point of three cells on the opposite side. The bottom of each cell thus forms a fourth part of a rhombic dodecahedron, and a third part of the bottom of each of the three opposite cells. Honey-comb is made by the bee, from scales of wax. See Wax.
Honey-Dew.—A sweet, saccharine substance found on the leaves of trees and other plants in small drops, like dew. Two substances have been called by this name—one secreted from the plants, and the other deposited by a small insect called *aphis*, or vine-fetter.—*Webster*.
Honey-Extractor.—A very ingenious contrivance by which centrifugal force is made to throw the honey from frames or pieces of uncapped comb.
Honey-Gate.—A cast-iron fixture for drawing off honey or other liquids from extractors, barrels, etc.
Honey-House.—A building used for storing honey, combs, hives, and apiarian implements; also for extracting honey and doing other work pertaining to the apiary.
Honey-Knife.—A two-edged steel blade, with inclined handle, used for uncapping honey before extracting.
House-Apiary.—A double-walled building, usually of octagonal or rectangular form, in which bees are kept both summer and winter in separate hives as out of doors. They are but little used now.
Hybrid.—A cross between two species. In bee culture, generally applied to a cross between blacks and Italians.
Hymettus.—A mountain of Greece, famed for the superior quality of its honey, which is of light golden color, and gathered from mountain thyme.

Italian or Ligurian Bee.—A native of Italy, characterized by three bands of yellow across the upper part of the abdomen of the worker-bee.
Italianizing.—Changing from any other species of *apis* to the Italian.

Introducing.—Method of presenting a strange queen to a colony of bees, so that they will accept her.
Introducing-Cage.—A cage constructed for the purpose of introducing queens.
Inverting.—See Reversing.

Lamp Nursery.—A device used in rearing queens; a double-walled tin hive, with space between filled with water kept warm by means of a lamp.
Langstroth Hive.—See Hives.
Larva (pl. Larvæ). The bee in the grub state, from the time of the hatching of the egg until the capping of the cell; in other words, unsealed brood.
L. Frame.—Langstroth frame. See Hives.
L. Hive.—Langstroth hive. See Hives.
Laying Worker. A worker that lays eggs which produce only drones. See Worker.
Ligurian Bees.—The name used by the English for designating the Italians. See Italian Bees.
Lining Bees.—Noting the direction of their flight.
Loose Frames.—See Fixed Frames.

Mandibles. -Jaws of the bee, which work sidewise instead of up and down, as in higher animals.
Melextractor.- Honey-extractor.
Metal Corners. -Tin fixtures for securing the corners of frames, and for forming, on the upper bar, an edged support, which can not be made fast by propolis, and under which no moth-worm can secrete itself.
Movable Frame. See Hives.

Natural Swarm. A swarm which issues spontaneously from the parent stock.
Nectary.- The lower part of the petals of flowers where nectar is secreted.
Neuter. -See Worker-bee.
Non Swarming Hive.- One so large, or so constructed, as to control the desire to swarm; an end never yet satisfactorily obtained.
Nucleus (pl. Nuclei). A miniature colony of bees, generally used for rearing queens or new colonies.
Nurse Bees. -Bees that care for brood; generally, those less than two weeks old.
Nymph. See Chrysalis.

Observatory Hive. -A hive constructed partially of glass, to allow examination of work inside without disturbing bees.
Overstocking. Having more bees in one locality than there is pasturage to support.

Paraffine. A white, translucent, crystalline substance, tasteless and inodorous, obtained from the distillation of mineral and vegetable tar. It resembles spermaceti. It derives its name from its remarkable resistance to chemical action. *Webster.* It is sometimes used as a substitute for beeswax, for coating barrels and other utensils for containing honey.
Parasite. A species of louse that lives on the bodies of bees.
Parent Stock. A stock from which a swarm issues.
Parthenogenesis (or Virgin Breeding). The law that life is imparted by the mother independently, and that every egg, as originally developed in the ovaries, is of the male sex, but whenever fertilized it becomes transformed into a female.
Perforated Zinc.—Sheets of metal, perforated with oblong holes, just large enough to admit a bee, but not a queen or drone.
Pickled Brood.—A mild brood disease, slightly contagious. (See Foul Brood, in the body of the work.)
Piping. See Queens' Voices, under Queens, in the body of the work.
Plain Sections. Sections with no insets nor beeways, having plain straight edges. See Comb Honey.
Pollen. -Fecundating dust of the antheral part of the stamens of flowers, gathered by bees, and, when mixed with honey, used for food of young bees. After being mixed with honey, and stored in cells, is sometimes called bee-bread.
Pollen-Basket. -A slight cavity on the outside, just above the second joint, of each of the two hind legs, in which the pollen is carried.
Propolis. A resinous substance gathered, probably, from the buds of certain trees, by bees, and used in covering rough places, and cementing and filling cracks about the hive.
Pupa. See Chrysalis.

Quahking. - Note made by young queens while in the cell. (See Queens' Voices, under Queens.)
Queen.- The only fully developed female in the colony; the mother of all the rest.
Queen-Cage.—An inclosure of wire cloth, or of wire cloth and wood, in which to confine a queen for introduction or shipping.
Queen-Cells.—Elongated cells, in which queens are reared.
Queening.—Introducing a queen to a colony.
Queenless.--Having no queen.
Queen-Rearing. -Raising queens.
Queen-Register. - A printed card tacked on a hive, having an index which the apiarist moves from time to time, to indicate the condition of the colony or queen.
Queen's Voice.—A note frequently uttered by a queen, often called piping.
Quinby Frame.- See Fixed Frames, in the body of the work.
Quinby Hive. See Fixed Frames, in the body of the work.
Quilt.—A cover for brood-frames made by putting wool or cotton between two pieces of cloth, and sewing them together.

Rabbet. -Applied to a narrow strip of folded tin, to be used in any hive where frames are suspended by the top bar, either with or without metal corners, to aid in making frames more movable.
Rendering Wax. Separating the wax from all foreign substances by melting. Usually applied to the operation of converting combs into wax.
Repository. An up-ground house or cellar for wintering bees.
Reversing.—The turning over, or inverting combs, in order to bring about certain results. For full particulars, see Reversing, in the body of the work.
Rhombic Dodecahedron. A solid having 12 rhomb-shaped faces.
Ripe Honey. That which has by evaporation become sufficiently thick to be sealed in the cell.
Robbing. The act, on the part of the bees, of pilfering stores from another hive, instead of obtaining them in the ordinary way from the fields. It occurs usually when no honey is to be obtained from the fields.
Royal Cell. See Queen-Cells.
Royal Jelly. Food of queen-larvæ. See Queen-Rearing; also Anatomy of Bees.

Sealed Brood. See Capped Brood.
Sealed Honey. See Capped Honey.
Section Box, or Section. A small box for surplus honey, open on two sides.
Section-Holder. A device or frame for holding sections while on the hive.
Separator. A strip or piece of tin or wood, placed between section boxes, to insure straight combs.
Sheet. A single covering of cloth, for brood-frames.
Shook Swarm. See Brushed Swarm.
Skep. A term sometimes applied to any sort of bee-hive. The term is used quite largely in England.
Smoker. An instrument for making and driving smoke among bees.
Solar Wax-extractor. A device for melting wax by sun-heat.
Spent Queen. One that from old age becomes incompetent to lay any eggs, or but few, which produce drones only.
Spermatozoon (pl. Spermatozoa). One of the animalculæ contained in the generative fluid of drones.
Spreading Brood. The putting of empty combs between combs of brood in the spring to increase the amount of brood. (See Spreading Brood, in the body of the work.)
Spring Count.—Number of colonies that survive the winter, and hence the number started in the season.
Spring Dwindling. -Slow decrease in size of stocks, in early spring.
Starter. Comb or foundation fastened in the top of surplus boxes, to induce work therein.
Sting.- A weapon of defense, contained in the posterior part of the abdomen of worker-bees and queens, composed of 3 parts, two of which are barbed.
Stock. See Colony.
Storifying.—A term used in England for "tiering up" in this country.
Super. Any receptacle for surplus comb honey, applied, to any kind of upper story, either for extracted or comb honey.
Supersede.—To replace or exchange a queen in a hive. Bees sometimes kill their own queen and raise another, and we commonly say they "supersede" her.
Swarm. A large number of bees leaving the parent stock at one time, for the purpose of taking up new lodgings, accompanied by one queen in the

first swarm, and in after-swarms (see Colony) by one or more.
Swarming Season.—The time of year in which bees are most inclined to swarm.
Syrians.—See Holy-Land Bees.

Taking up Bees.—Killing bees in fall, to get the honey. A practice now going rapidly out of use.
Tested Queen.—One whose progeny has been examined and found pure.
Tiering up.—Piling hives or supers one above the other. See Comb Honey, in the body of the work.
Transferring.—Changing bees and combs from one hive to another; changing comb from one frame to another. Usually applied to the operation of changing bees and combs from box hives to hives with movable frames.
Transposition Process.—See Grafted Cell.
Travel Stain.—The discoloration or dirt that is sometimes on and sometimes running clear through the cappings of comb honey. See Comb Honey.

Unqueening.—Removing queen from a colony.
Unripe, or Green Honey.—Honey which has undergone but little change by evaporation, and contained in unsealed cells.
Unsealed Larvæ.—Young bees in the maggot form not capped over.

Virgin Queen—A queen which has not been fertilized by mating with a drone.

Wax.—A natural, unctuous secretion of honey-bees, formed in delicate scales, in the eight wax-pockets, on the under side of the abdomen. It is formed both in activity and in repose, but in much larger quantities while the bees are quietly clustered inside the hive. The production of each pound requires 10 to 20 lbs. of honey. It is used by the bees for comb-building.
Wax-Extractor.—An apparatus by means of which wax is rendered by application of heat.


WAX-POCKETS.

Wax-Pockets.—The eight depositories under the rings on the under side of the abdomen of a worker bee, in which wax scales are secreted.
Wax-Press.—A device for rendering melted wax by pressure.
Wedding-Flight.—The flight of a virgin queen, for the purpose of meeting a drone.
Wild Bees.—A term applied to honey-bees that live in the forest, in hollow trees, or in cavities of rocks, away from the abodes of men.
Wind-breaks.—Tight fences or close hedges, to keep winds from the apiary.
Wintering.—Bringing the bees through the winter.
Worker Bee.—Erroneously called neuter; an undeveloped female, possessing the germ of every organ of the queen, which may at any time become sufficiently developed to allow her to lay eggs, but only such eggs as produce drones. Workers do all the work in the hive except laying eggs.
Worker Egg.—An egg which is impregnated, and is laid only by a fertile queen: will produce either worker or queen.

Doolittle's Review and Comments on the A B C Book.

In 1880 we employed Mr. G. M. Doolittle to go over the A B C book carefully, that he might point out its faults, and add such suggestions as his large experience might dictate. He did this; and his remarks are of so much value that we have added them here. Where obvious errors were pointed out, of course nothing remained but to correct them, and so these points need not be given here. In the edition for 1891 we employed him to go over it all *again*. In some cases I have answered his objections, but generally he has either given his indorsement or added some hint or fact not in the body of the book. To these of course we make no answer. The figures at the left correspond to the small superior figures interspersed here and there in the body of the work. The figure at the right gives the page from which the comment is taken, and to facilitate reference to point at issue. Where we differ the reply is put in brackets, and signed either "A. I. R." or "E. R."

1—See Introduction. Right here we see the great advance our industry has made. Not a single paper could afford to pay any thing for an article on bees as early as 1869 to 1873, unless it might be by giving a copy of the paper free to the writer, so, as you say, a correspondent had no "compensation of any account" as pay for articles written, or the necessary correspondence which always comes to the one writing articles. Now, however, nearly all the live papers pay as much for articles on bees as upon any other agricultural subject, so that the writer of articles can afford to answer all correspondents free, excepting the stamps inclosed.

3—page 1. Bees that work hard all day, in my opinion, do not "parade" about the entrance at night. This is left for the guards to do. These guards perform no duty except to look for intruders, while they are set apart for this work. These guards are of the age of from 20 to 30 days, according to the belief of one who has scrutinized closely.

6—page 2. Scarcely a queen need be lost, as a few bees will always gather around the queen; and by walking over the yard, and looking on the ground, this ball of bees is easily seen, and the queen picked up. It is not so easy, however, always to tell where they came from; but this can be done by keeping them till near night, and taking the queen from the bees, when they will return home to their own hives.

8—page 5. I find that a plurality of queens is just as common in second swarms as in third; and I have had as many as half a dozen in a first swarm, issuing from the loss of the old queen ten or more days previously. During the height of swarming, the cells are not properly guarded, and thus the young queens run out.

14—page 6. They will live 45 days, from three experiments I have tried. Again, under the most favorable circumstances black or very poor hybrid bees will live from the first of September till the fourth of the next July. August 9, 1888, I introduced an Italian queen to a colony of poorly marked hybrid bees, and saw the first yellow bee hatched Sept. 1, although there were few yellow bees hatched that fall. As the bees from this Italian queen were very yellow, I took pride in showing them to many who visited me the next year, so I kept more than usual track of this colony. July 4, 1889, there were at least 1000 hybrid bees in this colony; and as I had no hybrid bees in the yard except those, they must have been the same bees which were hatched the August before.

15—page 6. Twice I have had drones live over the winter, and that in hives which had good prolific queens. The season previous had been so prolific in honey that the bees in a few hives seemed to have no desire to kill off the drones in the fall as is usually done. The hum of these drones on warm days during February and March was very pleasant to hear, to say the least. When warm weather came for good these old drones soon disappeared. From this, and other facts which I will not take space to relate here, I have an idea that drones will live about as long as the workers under similar circumstances, unless their life is prematurely taken by the workers.

19—page 13. Have you not made a mistake here somewhere? During a heavy yield of honey, our bees seem to be glad of a rest, and it takes at least 24 hours before our bees think of robbing, after a full flow of honey. We have taken off honey after a shower, as you speak of, when each bee was so full of honey that, if squeezed a little, she would throw the honey out on the tongue; and, if jammed a little, the honey-sac (filled with honey) would burst through the sides of the abdomen. After 24 hours has elapsed, or the season draws to a close, we agree with all you say.

[I hardly think I have made a mistake in the matter, friend D.; but, very likely, more time had elapsed after the rain, than what I have given. I have noticed all you say, *immediately* after a very heavy yield; but so many others have spoken of having trouble in trying to extract, after a storm, that I can not but think my caution a wise one.—A. I. R.]

20—p. 14. I indorse all you say about being careful about allowing bees to get a taste of honey in times of scarcity, and know that such "taste" often makes bees cross or angry; but bees are often angered by some unavoidable accident, when they will buzz about one's face for hours, as you here describe. No matter what has caused bees to follow any one about in this way, they should at once be killed; for, according to my experience, if they are allowed to live they will keep this up for weeks, or by spells as long as they live, which makes them of little or no value as honey-gatherers. Such bees are dangerous to have around when friends come into the apiary, and for this reason I always kill them, and so have no trouble afterward till some mishap happens again. To be always prepared for an emergency of this kind I carry a little wooden paddle about with me in my tool-box and seat, the center of which is composed of wire cloth. This lets the air pass through the paddle in striking at the bee, so it is a sure kill every time; while if the paddle were made of whole wood, the air would often blow the bee to one side, so that several efforts might be required before hitting it.

28—p. 34. To this I say amen, after having tried the matter o ily at a loss in every instance.

31—p. 38. During a period of 22 years I have never known basswood to fail to yield honey, the very shortest season yielding three days, and the longest 29. I place basswood at the head of all honey-producing trees or plants as to yield. From it I once

obtained 66 lbs. in 3 days, *from one hive*. Taking the world over, white clover may, as you say, yield more honey than basswood; but no area of clover can possibly yield the same amount of honey that the same area of basswood will.

33—p. 40. This is a picture of which you may well be proud; for a better picture to convey to the mind just what basswood is, was never executed.

36—p. 47. You have not mentioned the *best* way to hunt bees; namely, that of going through the woods on the first warm days of spring, while there is still snow on the ground, and finding the "bee-trees" by listening for the humming of the bees on their cleansing flight, and by seeing dead bees on the snow, brought out in "house-cleaning." I once found two in an hour in that way, and at another time, three in two hours and a half.

37—p. 48. Not till the millennium dawns; for there always will be careless bee-keepers, and trees in the woods where moths enough will be bred to remind the most thorough apiarist that they still exist. I don't believe that apiary exists in the world, wherein a pile of combs can be thrown together in a pile during the summer season and not have them soon become a moth-nursery.

40—p. 53. With me the Carniolans are breeders out of season, like the Syrians; hence they are poor honey-gatherers. This, together with the imperfections which you have named, has caused me to get rid of them entirely.

42—p. 57. You do not mention water as being mixed with the honey and pollen for food. If water is not mixed with this food, why is it so eagerly sought in spring and summer, and not at all in warm days in October and November? Now, I claim that many things point to water being one element in this food; and one of these "pointers" may be found on page 5 of this A B C book, near the top of the second column, where you tell of the *brood* suffering for pollen or *water*.

49—p. 70. If I understand you correctly here, you and I do not agree at all. I never pulled the blossoms from a head of red clover yet, but that there was honey is them. But I have frequently found the corolla so long the bee could not touch the honey. I think there is nothing in the world that secretes as much honey, year after year, as red clover; still, it is of little use except to the bumble-bee. All that is lacking is a bee with a tongue long enough to gather or reach the honey. While length of tongue is lacking, the red clover blooms and secretes honey mostly in vain, so far as we and the honey-bee are concerned. Why I say "mostly," is because I believe fully 1000 pounds are secreted to where one is gathered by the honey-bee.

50—p. 71. While the name "mammoth" would denote that this kind of clover should have a larger flower than the other red clover, yet I find that the corolla is really shorter than that of the small kind, hence the bees work on it to much better advantage. Nearly all the red-clover honey I have ever obtained came from the mammoth.

57—p. 91. I say, put the empty super on top every time. Just as much honey can be obtained in this way, and you are not likely to get caught with a lot of unfinished sections at the end of the season. After a party has tiered up three or four cases high, and found nothing but partly filled sections in any of them at the end of the season, as I have known in several cases, he will be likely to put the empty cases on top for ever afterward.

[The majority of comb-honey producers will not agree with you. There are of course extremes both ways, and the golden mean is better.—E. R.]

58—p. 90. I have used such drone brood many, many times, and I have yet to see the first section that was any poorer for it, except the one which had the brood in it.

65—p. 108. This blossoms just with fruit, with us, and so is of little account, except the little they get before and after, at beginning and ending. Dandelion honey, after it is a year or two old, is just splendid.

68—p. 111. Fults, of Muscatine, Ia., says, in *American Bee Journal*, for January, 1880, that drones live only 24 days, while I claim they live to about the same age as a worker, if the bees allow them to live that long. See 15, or Doolittle's comments on age of drones.

70—p. 118. If you had said "practically pure," I would not have said a word; but when you say "absolutely pure," I can not withhold saying, "I don't believe it." For my views on this subject, see my book on queen-rearing, beginning page 107.

78—p. 119. My experience says that the trouble was not in the patches of honey, but in the pollen that was under the honey. Mice are very fond of pollen that is fresh from being preserved with honey.

90—p. 151. Yes, and many times the cappings will have the sunken appearance with minute holes, and still the brood be all right. This I know is so, for I have found hundreds of such cells in my own apiary and in other apiaries where I know the brood was all right. The only sure test is in opening the cells, as you say. Then if the pupa is found to be white, or whitish, with the eyes formed or colored, we may know the colony is all right, no matter how or what is the appearance of the cells.

107—p. 203. So far as I have been able to ascertain, *all* the cells which the cluster of bees surround are never filled with bees, except in cases of starvation. At all other times it is only the immediate cells next the outside of the cluster which are filled. This is done so as to form a living wall or crust around the outside, or so as to retain all the heat generated by the active, or comparatively active, bees inside. After Christmas most hives have brood inside the cluster to a greater or lesser extent, and surely bees would not pack themselves away in cells containing brood.

109—p. 204. We tried to so improve the bee as to make them take cells 4¼ to the inch, but we had to give it up, and believe God knew best when he taught them that five is right.

114—p. 216. Just because anybody and everybody can raise plenty of hybrids themselves, if they have an Italian to start with; but if they have a queen producing hybrid workers, they soon have nothing but blacks.

116—p. 217. I have had pure Italians that were ordinarily quiet and peaceable get so roused up as to sting worse than any hybrid ever thought of stinging.

[Perhaps, but that would be the exception.—E. R.]

129—p. 224. I have had Italian bees that did not show a particle of black on A, B, C, and only as much black on L as there usually is on B, while M showed nearly as much yellow on the horny scale as most Italians show on C. According to your theory these should have been poor workers; but, strange to say, they were among the very best for honey-gathering.

[Not necessarily. The point I endeavor to set forth that the rage for color is so strong that it is apt to overlook other qualities. It is not color but *honey* that brings the cash.—E. R.]

130—p. 223. My experience says *no*, unless it also disappears at B. In other words, if there is a yellow band at B, there will always be more or less yellow on C, if the bee is filled with honey and placed on a window. In the fall of the year the segments telescope so that the yellow on C is usually hid on poor specimens, hence the term "one and two banded bees."

141—p. 229. You know we don't agree here, as I claim they go from 3 to 6 miles from choice. My bees went 4 to 5 miles to work on teasel the past year, without any teasels within 3¼ miles on the first part of the route. This I know, as a bee working on teasel is always partly covered with a whitish dust, as they are with yellow when working on pumpkin and squash.

[Thanks; but I hardly think I have put the distance too small in the generality of cases.*—A. I. R.]

142—p. 231. This is something I do not understand. I frequently move colonies about in late fall, and have no trouble. The bees seem disposed to mark their location over again if they chance to have a fly in December or the last half of November, so I take advantage of this in shifting my bees where I wish them, and especially in doubling up nuclei. A few bees always hover around the old place for a little time on the first pleasant day; but from the fanning bees at the entrance of the moved hive, and the disappearance of the bees about the place where they formerly stood, together with no diminishing of their numbers, I am led to think that they found their way back all right.

*An article in April No. of GLEANINGS for 1882 shows conclusively that Italian bees will fly from an island, under favorable circumstances, as much as even SEVEN miles. We have since had corroborating testimony of such long flights.

114--p. 234. I have shipped many colonies of bees during the past five years; and although none of the combs have been wired, I have yet to hear of the first injured comb. As my combs are deeper than those in L. frames they would be more likely to be damaged than would those in the L. frame.

[Perhaps you do not ship bees to the extent that we do. Nuclei and colonies *can* be shipped many times on unwired combs; but our extensive experience has shown, beyond any question or doubt, that it is decidedly risky for us.- A. I. R.]

145—p. 236. We once had a colony become so reduced that, by actual count, there were 81 bees and the queen, and so they held on till warm weather, when they built up without help, and actually gave a surplus of five pounds on buckwheat, in sections, and were in splendid condition for winter. The next year this colony did the best in comb honey of any colony in the yard. I wish to do away with the idea which prevails, that a queen from a colony which has "spring dwindled" is good for nothing.

[Why, friend D., it seems to me our bees don't act just as yours do, but perhaps we are both a little prejudiced.—A. I. R.]

150. -p. 252. If I am correct, basswood yields no pollen at all. Elm, beech, and poplar trees, as well as sorrel, buttercup, etc., among plants, yield large quantities of pollen, but no honey.

151—p. 247. To Dr. Miller's 358 I would add: That depends. With me, when the dandelion, hard maple, wild grape, and sorrel, are in blossom, at least half the bees going into the hives have loads of pollen, while in the basswood-honey harvest, not one bee in 200 has any pollen in its pollen-baskets.

161—p. 270. No. It is the cocoon which the queen spins that is "tough an leathery." The material of which the cell is made is little if any more tough than that of the ordinary worker-cell. But here is a strange thing which I do not know that I have ever seen mentioned: The worker larva, when she spins her cocoon, attaches it to the bottom and sides of the cell, so that, at the point where she bites off the covering to the cell, there is little if any of the cocoon; while the queen-larva spins her cocoon right the opposite, having the thickest part of the cocoon right where she must bite her way out, the bottom of the cell having no cocoon in it whatever. Now, whether this is brought about for the purpose of making it hard work for a rival queen to bite through the cell when she wishes to destroy the inmate, or whether it is done so that the queen larva can still partake of the royal jelly while she is spinning her cocoon, I do not know; but I do know that the facts regarding the position of the cocoons in the different cells are as above stated.

162 -p. 271. The first hatched queen is enthroned as "ruler" of the colony, so she is in no way molested by the next queen allowed to hatch, hunting her up as you here infer. It is a rare thing that the second queen is allowed to hatch, unless the bees intend to swarm again, in which case the second hatches after the first has gone out with the swarm. Once in a great while a whole lot of queens are allowed to come out of their cells and walk about the combs; but in all such cases, so far as I have observed, the first queen pays no attention to these, but they are dragged or driven out of the hive by the workers, and the first one becomes the mother of the colony.

163- p. 272. As far as my experience goes on this point, the workers do this destroying of the cells. I know queens do tear open cells but believe the workers do most of it when the idea of swarming is not entertained.

164- p. 272. In all cases of after-swarming there is no chance for a fight, as all but the first-hatched queen are kept in their cells.

186 p. 293. I had plenty of snakes live under my hives one season and the idea that bees dislike snakes is all bosh. I have seen snakes glide in and out of the entrance to different hives, but the bees paid no attention to them.

[Yes; but snakes pay attention to the bees. They once for us depleted a full colony, besides making inroads into quite a number of others. The bees may not dislike snakes, but the snakes certainly do like the bees. E. R.]

187—p. 294. You do not say a word about the bees crawling all over one when working by lamp or lantern light. This I find to be a perfect nuisance with me.

[If you work *right*, they won't crawl all over you. Don't get too close to the lamp or lantern.—E. R.]

189—p. 290. Smoke will drive yellow-jackets and bumble bees much quicker than it will bees, so they will leave their nests entirely—the yellow-jackets rarely returning, but the bumble-bees will return.

191—p 309. This is the way I always remove them; and if you learn by instinct, as it were, to strike your hand against your clothing at the moment you feel the strike to sting, you will, in nearly all cases, remove the whole sting, and suffer scarcely any pain. I always wear a veil, as I don't want them in my face if they did not sting at all

A bee must always "lay hold," as it were, with its feet before it can sting; and after practicing striking my hands down on my clothing to rub stings out, for years, it has become, as it were, second nature to me, so that, as soon as I feel this "laying hold," my hand, or the part the bee is on, comes to the clothing without thought, so that not one bee in five which intends to sting me succeeds in doing so. When I go out into the bee-yard without a veil, the same instinct, or second nature, brings my sleeve up to my face when a bee alights on me there to sting, so that I can safely say I do not get stung once now to where I used to ten times fifteen years ago I also know in an instant whether a bee which alights on me intends to sting or not; and when it does not, no inclination comes over me to rub it off.

193—p. 311. This is the worst trial I have, and I sometimes feel like telling such persons that it seems as if they should "know something;" but instead, I request them to come back where I am, only to repeat it when I open the next hive, and so on. Isn't it strange that some folks can not learn any thing?

194—p. 311. This is more common with the blacks and hybrids, very little of this angry buzzing being done by the Italians. The Cyprians are the most vindictive of any bees I ever handled; but, strange to say, they would allow you to stand for hours at a time right in front of the entrance, turning out for you or putting up with almost any inconvenience as long as their home was not molested, without any of this angry buzzing or giving a single sting; but let some little mishap occur while opening the hive, and a quart of angry bees would be on you in a moment.

195 p. 311. I never had any bees but the Cyprians that would follow me through a door; but these fellows would do so, and sting equally bad in a room as anywhere else. It was after a fight with 50 to 75 of these fellows in my shop (fighting till I had killed every one of them, because they insisted on coming into the shop and stinging), that I decided that they must go, for the Cyprian bees are the best honey-gatherers of any of the races.

196—p. 312. I carry a "paddle," made of wood and wire cloth, in my work-box; and if any bee insists on following me two rods from its hive, I always kill it with this paddle, and thus my apiary is always kept free from angry bees. The wire cloth is inserted in the center of the wood, so as to allow the air to go through the paddle, thus making sure of hitting the bee every time, instead of blowing it one side, as is often the case where only solid wood is used.

[This is a good thing; and since we got the idea from Doolittle we have a number of them on hand. - E. R.]

197 p. 305. The busy man has no time for this. Take off the cover of the hive, raise one corner of the quilt, and, as you "peel" it off, give two or three gentle puffs of smoke under the quilt and over the tops of the frames. You can now go about your work with this colony of bees with rapidity; while, if you try to get along without any smoke, you must work slowly; and, ten chances to one, after all your care the colony will get aroused, ten times the smoke now having to be used that would have been used on the start if worked as I suggest, and many cross bees be following you around, if not killed. Don't let us get too sentimental over any practical work in and about the apiary.

201—p. 315. I always blow a little smoke under the quilt as I raise it, and after that use no more unless they show signs of stinging. In this way no time is wasted to have them off from the tops of the frames out of the way. Any colony can be subdued by blowing in a little smoke at the entrance, and closing it, and then rapping on the hive a few times.

In two or three minutes you can do anything with them.

202—p. 311. Why not say bees swarm because it is God's plan to keep them from becoming extinct, as much as it is his plan for the birds to return to us each spring, mate, and raise their young? With an apartment that is suited to the bees for all seasons of the year, that is not enlarged or contracted by man, the bees invariably swarm if the season is propitious, and all the combined ideas of man have not as yet been sufficient to produce a non-swarming hive when worked for comb honey, that was reliable.

205—p. 319. How about the comb they would build? At present prices of wax, this would be worth more than "a fly."

206—p. 312. I never could see a bit of difference as to the work of a colony, and I have watched closely to see, when I knew a colony had a sealed queen-cell.

210—p. 320. No mistake so far as my experience goes.

211—p. 326. The hive which begins to "draw" the bees first will usually get the larger share of these bees. To obviate this I use two plans, the first of which is to put a sheet over the one that the bees go to first, as soon as it has nearly or quite its proportion of bees, which causes the rest of the bees to go to the other location. If more than two are out, a sheet is put over the second hive when bees enough have entered, and so on till I have them where I wish. The other plan is to place a caged queen with the large cluster to hold it till all get settled, and I have the hives all prepared, when I dip a certain number of measures full of bees to each hive, letting each swarm have one of the caged queens, and all are where and just as I wish them.

212—p. 326. I never knew but one first swarm to issue the second time on the same day—a returned swarm, I mean.

216—p. 328. I don't agree; your extracting reduces them, for the time being, to a state of poverty, the same as a dearth of forage; hence, all idea of swarming is given up the same as it is when the flowers yield no honey, on the principle that God has given them knowledge enough to know that they can't prosper outside of the old hive without a yield of honey. The above holds good where small hives are used. Large hives filled with comb or comb foundation tend to keep from swarming, whether the extractor is used or not.

226—p. 336. Don't lay the hive on its side at all, but stand it with its mouth up. In this way you can cut the nails just as well, be in no danger of injuring the combs, and, by putting a box partly or wholly over the mouth of the hive while doing this work, the bees will all run up into the box out of the way.

227—p. 339. Alternate the frames, and thus mix the bees thoroughly, and they will never fight at any time of the year.

[But they do *sometimes*, friend D., *with us*, nevertheless. I wish you would try uniting Cyprians in that way.—A. I. R.]

228—p. 339. The honey will be removed much sooner if placed under the bees.

229—p. 339. I never lost one in my life.

230—p. 340. I don't agree. August is the time to unite bees. The first part of September would do, where fall flowers are abundant. It is far easier to unite bees in the brood form in August than in the bee form in October, for the brood the last of August are the bees of October.

231—p. 340. The better way is to shake the swarm, that has been hived from two days to a week, out of its hive, in front of the same; and while they are running in again, shake the swarm down with them. In this way I never knew any fighting, but I have had nearly all of the swarm killed, in spite of all I could do, by allowing the new swarm to run in with the one hived a few days before, when those established in the hive were not disturbed before attempting to run in the new swarm.

232—p. 341. I wear it all the while when I make a general business of working with the bees.

233—p. 345. You are just "shouting" here, and this is one great secret of success in getting box honey. To keep the surplus apartment as warm and nice as it should be, a cap or hood to each hive is almost a necessity.

240—p. 358. The reason why you did not see that "spoonful" of honey was because you did not look in the right place. If you had taken a bud a little more advanced than the one in the left of the cut, one just ready to blossom, and torn it open, you would have found the honey. In this locality the wasps and hornets bite into these buds near the middle, so as to get at the honey before the blossom opens; and after they sip what they wish, the bees take the rest. I have often seen as much as a teaspoonful of thin nectar in a single whitewood bud.

245—p. 366. The Good candy is best for winter feeding, and it is a great convenience to have a piece of wire cloth over the frames to keep the bees out of the way while you are putting the candy on and looking after things.

246—p. 369. If that warm day comes. We frequently have from 120 to 160 days here in which the bees can not fly; and in such cases they are better off in the cellar.

247—p. 370. If the temperature is right. A damp cellar needs a higher temperature than a dry one, to winter bees successfully.

248—p. 370. If the cellar is a proper one, an open winter should make no difference with it, hence I do not see any logic in this sentence. If the bees are short of stores in the spring, it is easy feeding them after they are out of the cellar.

249—p. 370. I use my sawdust cushions on the hives which are put into the cellar, just the same at I do on those outdoors, and like them much. Perhaps I should say that the hives which are put into the cellar are chaff hives also.

250—p. 371. Don't wait for snow. Put them in some quiet day with the mercury at 38 to 44 degrees, and you will never wait for snow again.

252—p. 373. I should consider bees better off on their summer stand than in a cellar that would vary 10 degrees in temperature. Such a variation tends to make the bees uneasy, causes them to go to breeding, and often results in diarrhea and spring dwindling. My bee-cellar has not varied four degrees between the hottest and coldest temperature, while the bees were in it, during the past fifteen years, it usually standing at from 42 to 43 degrees.

254—p. 374. In re covering my cellar with flagstone I did not make any provision for ventilation, so the ventilator shown at 6 is not on the cellar now. I see no difference in the behavior of the bees, now the ventilator is off.

258—p. 376. As you advise waiting till pollen is plentiful (which advice is good), your advice as to the time of day in putting out is bad, as it is so warm at this season of the year that robbing will likely result from those set out previously, or from those wintered on summer stands. Commence to set them out about four o'clock, not setting any out later than when the sun is an hour high, on a warm day, and they will have a nice fly, and protect themselves the next morning.

259—p. 376. All of my experience says weak swarms from the cellar are no more liable to swarm out than are those of the same strength wintered on their summer stands.

260—p. 376. I put half an inch of dry basswood sawdust on the floor of my cellar every month during the winter, which answers instead of sweeping the dead bees up, and keeps all dry and sweet.

261—p. 377. I never used a stove except one year, and then I lost nearly all of the bees.

262—p. 380. The uniting of spring-dwindling colonies does no good. If they will pull through united, they will do so singly. I have put as high as eight such colonies together, and at the end of two weeks they were no stronger than colonies not united, which were no better than either of the united ones were two weeks previously.

263—p. 380. I believe these bees die of old age, caused by a used-up vitality from holding the excrement so long. If you will consider, you will see that all evidences point that way.

Friend Root:—Although I have been pressed for time and hardly knew how to do it, I have thoroughly read the preceding pages, and criticised what I considered wrong. I may not have clothed my language with as smooth a dress as some would have done; but, believe me, I have not intended to be harsh, and if you find any thing that so sounds, please forgive. I did not intend any thing but kindness.

Borodino, N. Y. G. M. DOOLITTLE.

Miller's Review and Comments on the A B C Book.

The comments of Mr. Doolittle proved so valuable that we employed a no less practical and prominent bee-keeper to likewise review and comment on the general subject matter. This he did in 1880 and 1900 As is pointed out in the preface, the editions for 1899 and 1900 were so much re-written that an entire new set of comments have been prepared. Although we differ on some few points it will be interesting to the reader to notice how nearly we agree in our experiences on all the fundamental principles of the pursuit. It is to be observed that Mr. Doolittle's comments are numbered from 1 to 265, and that Dr. Miller's begin with 305 and include all successive numberings. As before, the figure at the right indicates the page from which comment is made. The paragraphs in brackets and signed "E. R." are the replies of the reviser.

305—p. 1. The advice given as to the manner of using the book is all right. It should be added, however, that the beginner who wants to take his place in the front rank as a bee-keeper will not be satisfied without *also* reading the book through by course once if not several times. Unless he does this, there are parts of the book he might never read, possibly omitting what would be of great value to him.

307—p. 6. A variation from this plan makes it easier and just as good. Hive the swarm on the old stand and set the old hive close beside it, both facing the same way. A week later, when most bees are out, remove the old hive to a new stand. That leaves the old colony just as much depleted as the longer way; and the depletion coming more suddenly will more thoroughly discourage all thought of further swarming.

308—p. 9. For sweetening coffee or other hot drink, I have never liked any other honey so well as alfalfa, probably because of its mild flavor.

311—p. 10. You must not judge every one by yourself. Probably not one in five has ever carefully watched a bee using its tongue, or can tell you whether it sucks or licks.

[The sentence in question was not intended to imply that every one knew the exact *modus operandi* of taking honey up through the tongue, but to call attention to what every one knew; viz., that the food *is* always taken up through the tongue. However, the *modus operandi* is given fully under TONGUE, which see.—E. R.]

313—p. 11. This wonderful stomach-mouth solves a very difficult problem. Honey or nectar swallowed by the bee goes directly into the honey-sac, where it may remain for days unchanged, just as if in a glass can. When the bee desires, it takes honey or pollen from the honey-sac into the chyle-stomach, where it is changed into chyle. This chyle the nurse-bees feed to the brood, as also to the queen and the drones. But how can chyle be passed from the chyle-stomach out through the honey-sac without having a lot of raw nectar mixed with it? The stomach-mouth solves the problem by moving up and joining itself to the œsophagus, leaving the honey-sac shut out entirely.

315—p. 22. If you think that plan is the most economical of room, I'm afraid you never figured on the simple plan of having four hives in a group, one pair side by side with another pair having their backs to the backs of the first pair, 3 inches between hives in group, groups with 3 feet between them in the row, and a 16-ft. alley between rows. I've used the plan for many years, and like it much. By it you can put on a lot 75 ft. square, instead of 20, 96 colonies, and have no hive come within 5 feet of the fence. With only 3 inches between hives (they may be only 1¼ inches apart) no grass grows between.

[If the hives in the several groups on the S. E. Miller plan were placed only 3 inches apart, and the space gained closed up between the several groups, is it not true S. E.'s plan would be able to accommodate more hives in a given area than your plan?—E. R.]

317—p. 28. Possibly the colors would be more distinct to omit the green, or at least not to have it come next to blue and yellow, which two colors combined make green.

323—p. 38. The age of a basswood has much to do with the size of the leaf. On trees with trunks less than a foot in diameter on my place, the leaves are from 4 to 6 inches long; on old trees very much smaller; and on water sprouts the length is 9 inches or more. I wonder if every reader has noticed that the leaves in that excellent picture are lop-sided—oblique, the botanists call it. All basswood leaves are so.

[You are quite correct, that the age of a basswood has much to do with the size of the leaf.—E. R.]

325—p. 50. Your advice is excellent—no plr co so good for idle combs as in the care of bees, but sometimes it may be desirable to delay giving them to the bees. Spread apart in a cool cellar, they may be kept till quite late in the season without the worms doing much harm. But close watch must be kept when hot weather continues.

327—p. 55. Would you mind telling us when? Years have passed since the first talk about introducing them, and at different times we've been told they were just about to be introduced, but how much nearer are we to their introduction to day?

329—p. 56. Was that in a full colony? Cowan gives 5 days' feeding for worker and queen, but in a nucleus it may be longer.

[It was a full colony; but it is possible there would be a difference in the times and circumstances; but A. I. R. says his figures were vorified by others who were experimenting at the same time with himself.—E. R.]

331—p. 57. I have observed somewhat closely for years, and I think these bees are bareheaded because worms have eaten the cappings.

333—p. 64. You are putting it very mildly. In an ordinary locality there is generally something to be gathered by bees every day from early in April till late in October. Give a single colony the entire field, and for about six months it will gather daily enough for its own support and a surplus besides. Increase the number to ten colonies, and half the time there will be only enough pasturage to supply the bees' daily needs. Run up the number to 100, and the number of storing days will be reduced to 30 or 40, while the rest of the time the bees will barely get their own supplies if, indeed, they do not draw on the stores already garnered.

[Yes, I intended to be clear inside of the limit; but localities vary so much that I think the limits as I stated them would not be far amiss.—E. R.]

335—p. 64. "If one doesn't care for expense," how would it do for him to send off for three or four full colonies? After some experience one can do

well building up nuclei, but there's some danger that a beginner may make a mess of it.

[Yes, but that would be going to the other extreme. Express companies charge a rate and a half on bees; and if one were to send a distance for four or five *colonies* he would have an express bill that would be more than the value of the bees.--E. R.]

337—p. 64. "For most localities" Hoffman frames may do; but it would be well to advise against them wherever propolis is plentiful. After some years' trial it would take a good deal of money to hire me to let any one transfer all my combs into Hoffman frames.

[From extended observation I am satisfied that your locality is one of the very worst for propolis. See answers to comments 423 and 427.—E. R.]

339—p. 69. While this may not be accounted for in some cases, in others it may be accounted for by the fact that in a large vessel the honey at top differs from that at bottom. A vessel filled from the top will, of course, differ from one filled from the bottom.

339—p. 124. I think there is danger that the entrance would be worse clogged if stopped with wire cloth. Besides, in the cellar the dead bees may need cleaning out several times in the course of the winter, and the wire cloth would be in the way.

341—p. 70. I feel quite sure that you will find white Dutch precisely the same as common white clover. Under favorable circumstances the common white grows very large.

343—p. 71. Alsike well deserves a place in the flower-garden. A bouquet of alsike is very beautiful and *delightfully fragrant*. Like some others, however, I have failed to make it a profitable crop.

345—p. 71. Perhaps alfalfa will wear as well as clover honey, partly because not strongly flavored. But you may reply that alfalfa honey is clover honey.

347—p. 72. Unlike red clover, the stalks of hay from alsike clover are all eaten clean.

349—p. 73. The localities where sweet clover is valued for forage seem to be on the increase all the time. Is it not possible that it is valuable everywhere if stock is taught to use it?

351—p. 74. The time of blooming of the yellow is said to vary two weeks from that of the white.

353—p 74. I have eaten honey with such a rank sweet-clover taste that I did not like it. Possibly it was not properly ripened. The finest comb honey I ever tasted, without exception, according to my notion, was some that seemed to have a kind of vanilla flavor. I *think* it was white clover with a small quantity of sweet clover.

[I have tasted just such honey as you speak of; and at the time, I thought it the most beautiful and finest-flavored honey I ever sampled, but I did not then suspect the presence of a small amount of sweet clover which gave the honey its delightful flavor. E. R.]

355—p. 91. Nowadays I pile the supers up beetight, 5 or 10 supers in a pile, and put a tent-escape on top as in the cut of Miller's tent escape. The artist, however, has drawn on his imagination a little. The device is nothing but a common robber-cloth; and the escape, instead of being conical, is pyramidal or three-sided, which is much more easily made.

359—p. 94. My experience varies a little from yours. I do not find these unfinished sections quite as good eating as those fully sealed, the unsealed cells not being ripened; but instead of having to sell them for 4 to 7 cents less than the market for finished sections, I can generally sell them for 2 or 3 cents less.

[Very likely you are right.—E. R.]

361.—p. 97. Isn't your philosophy a little off here? Carry the matter to extremes. Suppose two sections, each 4 inches wide, one 10 inches high, the other 1 inch high. Do you imagine the 10-inch section will carry more safely than the 1-inch? But according to your philosophy it should.

[This is the point that I ought to have brought out in connection with the statement in question: No matter what the section is, there are apt to be large or small-sized holes at the lower corners. The perpendicular edge without comb attachment is anywhere, at these corners, from ¼ to ⅜ inch high, no matter whether the sections are tall or square. There will therefore be more perpendicular edge of comb contact *in proportion to the height* in the tall box than with the other. To take an illustration: Suppose one section were 2½ inches high and another 4 inches, and that the lower corner holes in both would have a perpendicular edge of side unfastened ½ inch. We should have five times as much comb attachment in proportion to the height in one as in the other. Again, suppose we have one section 4x5 and another 4¼x4¼, both sealed clear out to the wood all around. The perpendicular edge of contact in the former would be 4¾ as against 4 inches in the latter.—E. R.]

363—p 100. I don't know how it may be in other localities; but in mine the soiling of sections by the feet of bees is not worth mentioning. I doubt whether it could be recognized in one section of a thousand.

365 p. 100. Strictly speaking, not one in twenty of my darkened sections would come in either of these four classes. When I formerly had sections in wide frames sealed while facing brood-combs, I had some of the second class, but none with thick top-bars between brood-combs and supers. Nearly all of my darkened sections come in this way: They are first sealed over snow-white, and then if left on long enough are darkened. I *think* the darkening is caused by bits of black comb being carried up from the brood-combs and plastered over the white cappings. The rule is, that, if taken off as soon as sealed, there are no dark sections. With white-clover honey I think there is no exception. Some late honey seems to have a sort of varnished look when first sealed.

[There is something about this matter I do not understand. The discoloration or soiling of nine-tenths of our travel-stained sections I have examined goes clear through the cappings, and I should be inclined to believe that nine tenths of *your* sections that were travel-stained, so called, belong to the second class I have described in the body of the work. But I can not account for the fact that they are white to start on, and then are discolored after being on the hive for a time. I should be more inclined to believe that such sections were really travel-stained. You can easily prove the matter by washing the surfaces with a sponge saturated in gasoline. If, after the bathing, they whiten, then of course they would belong to the first class.—E. R.]

367—p. 104. It may be all right to supply glassed sections where the market demands them; but I wouldn't think of introducing them where not already in vogue. The glass is mostly a dead loss, and some one must stand the loss. If the sections are glassed, your customer does not get as much eating for a dollar—a bad thing for him and you.

[In the East the question of extra cost is not considered. The customer seems to want something that he can handle roughly, and put in his market-basket along with other groceries. There are surely good arguments against the use of glass; but the once established can not be ignored or broken down. If you were in the East, and the market called for glassed sections, you would furnish that kind of goods. If the dear public insists on paying two prices for the glass at so much per pound for the honey, let them have what they want.—E. R.]

371 -p. 105. I have known the reverse custom, which, although not so bad, is still not good. Quotations were given a cent or two below the market, then honest returns were made, and each bee-keeper was tickled with the idea that he was getting a cent or two above the market.

375 -p. 108. You are quite right as to dandelions being on the increase; and a curious thing about them is that their season, at least in this locality, seems to have been greatly prolonged. They bloom more or less all through the season; and as I write this, Oct. 29, 1900, as many dandelion blossoms are to be seen as in spring 25 years ago. But bees don't seem to do much on them so late in the season. Their value in spring is great, they having a longer season than fruit-bloom. Some complain that they are getting so plentiful that the dark honey from them is mixed with the white clover; but the gain is probably much more than the loss.

379 -p. 110. As far north as latitude 32° it is hardly worth while to go to the trouble of removing a colony of paralytic bees. The disease appeared among my bees 20 years ago or more; and although I never did any thing for it there was never but one case so bad that the colony was destroyed. So far from being on the increase, I do not remember to have seen a single case in this year, 1900.

[I must take issue strongly with you here. While so far as you and your bees are concerned, no harm would result, yet the moment you begin to sell queens, that very moment, unless you keep all paralytic cases out of your apiary, you incur the risk of transmitting bee-paralysis to a locality where it may prove to be most destructive. Am I not right? It is a well-known fact that the disease does but little harm in the North; but it is most virulent in some sections of the South. You sell queens, and so do we; and the only way to avoid the danger of transmitting paralysis is to establish a quarantine for the sick bees.—E. R.]

383—p. 111. July 8, 1860, twenty-eight years before the date you mention, the same thing was observed by W. W. Cary and R. C. Otis. Father Langstroth reports it in the *American Bee Journal*, Vol. I., p. 66.

385—p. 116. If the scientists tackle problems of that sort they will have their hands full. Why are some people red-headed? Why have some people pug noses?

387—p. 116. The term "diarrhœa" is oftener used now than "dysentery," and perhaps should displace it altogether, for the disease acts more like diarrhœa in the human subject than dysentery.

391—p. 117. Is not a good cellar in proper condition just as ready a means at the command of some?

[A good cellar is probably just as well where cellar-wintering is found to be advisable.—E. R.]

399—p. 119. Mice are not so apt to riddle surplus combs in which no brood has been raised, as old black brood-combs. These they will chew up fine, perhaps on account of the cocoons, (may they not contain a trifle of sweetness?) and I think in such combs I would rather have occasional batches of honey, or honey accessible near by, in hopes that they might gnaw the combs less. One year mice were plentiful in my honey-room, where were thousands of sections, and scarcely a section was touched, because extracted honey was allowed in daubs on the floor. Extremely untidy, but it saved dollars.

403—p. 121. I do not know that there is any more chance of clogging in single-walled hives, providing they are wintered in the cellar.

407—p. 121. The entrances to my hives were ⅜ inch, full width of the hive. I found it so difficult to clean out the dead bees, in the cellar, that I took a 2-inch chisel and enlarged all the entrances to ½ inch. I think I like this better for all times of the year. In early spring a pine stick closes up the entrance so only a few bees can pass. If at any time this seems to crowd them the entrance is enlarged; and when hot weather comes, the whole entrance is left open.

[But your locality is an exception so far as propolis is concerned. I have not found the equal of it anywhere else in the United States, and I have traveled over nearly every State in the Union.—E. R.]

427—p. 151. I have some of the original Hoffman frames, and after the bees have had them four or five years it is a work of magnitude to get out the frames. I think a beginner would be likely to give it up before getting out the first frame. The improved Hoffman, with only the end-bars touching, is a great improvement. But it is still decidedly objectionable. I do not know of any advantage it has over a plain frame spaced with 4 nails, unless it be that the partially closed end makes it a trifle warmer, and the gain is so small in that direction as to be entirely overshadowed by the disadvantages. The Miller frames, as I call them for want of a better name, are spaced at bottom as well as top, while the bottom-bars of the Hoffmans are by no means at fixed distances, and the same space will answer for Miller frames year after year, while a set of Hoffmans, after being in use five years, must have the hive enlarged or the bee-glue cleaned off. Squeezing together will not keep the frames in the original space. Where there is no propolis, Hoffmans are all right; where propolis is reasonably plentiful they are all wrong.

[See answers to comments 423 and 337. But I do not see why you attach so much importance to the spacing of the bottom-bars. Those of the Hoffman frames in our locality, when squeezed together, are almost as evenly spaced as the top-bars. If the frames are nailed up properly there ought to be no great irregularity.—E. R.]

431—p. 162. Those having an excess of physical strength, and those who work only occasionally at bees, may like a seat of this kind; those who have no strength to spare, and work all day, need something more stable. With such an unstable seat, a certain set of muscles must be kept at work all the time keeping the balance, and this tires. Something like a common glass-box makes a very good seat.

[But the feature of this kind of seat is that it can be tilted back and forth, milkstool fashion. I follow no invariable rule in working with the bees. Part of the time I sit down, part of the time I kneel down, and at other times I stand upright, bending over only to remove the frames.—E. R.]

435—p. 163. When I first handled frames, the breaking-out of a comb now and then was a wonderful quickener in teaching me to handle them the way you instruct. From long habit I still handle them as you direct, but it is somewhat doubtful whether it is worth while for the beginner to learn it nowadays if his combs are all securely fastened in the frame as they generally are. It takes just a little less time to whop a frame right over without any circumlocution. The beginner is about as likely to have combs break out by leaning them against the hive as he is in handling. He leans them too nearly horizontal, and, being warm and soft, they gradually sag out of place before he notices it. After experience he leans them more nearly perpendicular.

[The majority of bee-keepers do not wire their frames, if we may judge by the orders as they are received; therefore the advice to handle frames in the manner explained is, to say the least, safe.—E. R.]

439—p. 166. Fortunately that does not restrict one to the Hoffman, for my frames spaced with nails can be handled in pairs and trios with entire satisfaction.

[See answer to comments 427, 437, and 423.—E. R.]

443 p. 175. Probably not another dozen consecutive pages in the book can a beginner omit in reading as safely as this dozen about hive-making. One man out of ten may be so situated as to make it desirable for him to make his own hives, although one out of fifty is probably nearer the mark. That one may read "Hive-making" advantageously. It is cheaper and better for others to buy hives ready made. If I buy my hives ready made I don't care to learn all about hive-making any more than I want to learn shirt-making in order to buy a well-fitting shirt. Still, it may pay the beginner to wade through the dozen pages for the few side-lights on bee-keeping he may catch.

[There are probably more bee-keepers than you are aware of who desire to know all about hive-making and the handling of a buzz-saw. I have been surprised in my travels over the country to see how many make their own fixtures, or at least a part of them. There are some bee-keepers who are real mechanics, but I have explained in the text the circumstances under which one can afford to make his own supplies.—E. R.]

447 p. 181. I would not want cleats "all around the hives," but most emphatically I want a cleat at each end, as long as the hive is wide. You say cleats "interfere in closely packing the hives together for moving." Nowadays you make hives with the new handles as shown in the cut on page 197. These new handles are just as much "in the way," and take up precisely the same room in packing, as my end-cleats. The cleats "add to the expense." Perhaps one cent on a hive more for the two cleats than for your hand-holes and handles. Let us see how much convenience we buy for that cent. "A little handier to get hold of (I forgive you the "little"), and two can take hold as well as one. When carrying a heavy hive you can let the cleats rest on the entire length of the forearms, the fingers clasped around the hive, instead of having the fingers support the entire weight of the hive. About the weakest spot in your hive is the top at each end, where the rabbeting leaves the wood $\frac{3}{16}$ of an inch thick. That part is easily split off; but reinforced by an end-cleat it becomes $1\frac{3}{16}$, and is one of the strongest parts of the hive. Whenever I can get as big a cent's worth of comfort as that for my money, I'll not begrudge the cent.

[End-cleats clear across the hive make a clumsy-looking box; and, besides, the cleats do not give as good a length of finger-reach as the cleat *in connection with* the hand hole. In spite of your arguments I am ferninst you on the long hand cleats. And talking about "comfort," it seems to me it is with the combination recommended in the text. No, from my standpoint I will save the cent and earn another cent's worth of comfort in using the up-to-

date hand-lift. After all, a great deal depends o.. what one is used to.—E. R]

451—p. 182. The difference can hardly be realized unless one handles the two kinds side by side for years as I have done, part of the top-bars being ⅜ thick, and part ⅞. One advantage of thick top-bars is seldom mentioned. It is that sections over them will be whiter than over thin top-bars. If sections are very close to brood combs, the bees will incorporate bits of the black brood-combs in the white cappings of the sections, and, even if not so very close, they will daub some of the black wax on the surface of sections left on a considerable time. With top-bars ⅞ thick the carrying up of black wax is so small that it is sufficient reason, if there were no other, for having thick top-bars.

455—p. 183. No matter how carefully top-bars may be spaced, if the bottoms hang free they will in a few years vary an inch in spacing if the bottom-bars are not too wide. Much better have a fixed distance for bottom-bars as well as top-bars.

[See answer to comment 427.—E. R.]

459—p. 183. Are you sure you couldn't handle them in pairs if they were spaced at bottom as well as top? There is no trouble in picking up at a time three of my nail-spaced frames, but possibly the staples may not work just the same.

[Yes, but not so easily. The Hoffman frames will stick together while handling, and when leaned up against the hive will hold together in a body.—E. R.]

463—p. 183. Whether it be the bee-keeper or the locality, I know you couldn't get me to use any more Hoffmans if you would give me the frames for nothing, and then pay me five times their price for using them.

[See my answer to comments 427, 423, 437.—E. R.]

467—p. 190. A niche still stands vacant awaiting a satisfactory hive-cover. Such a cover must be rain-proof, non-warping, non twisting, and must have a dead-air space so as to be warm in winter and cool in summer. The cover you describe is good, but it will twist so it will not fit close, and it lacks the air-space.

[But does the cover we describe twist any worse than any other cover of a different pattern? I don't know how a non-twisting cover can be made unless constructed of stone or iron. About the air-space, the cover shown on page 190 is constructed with that point especially in view. The space may be made dead-air, or open for purpose of ventilation.—E. R.]

474—p. 201. Possibly it is not so much being used to any particular kind of honey as it is a natural difference in taste. In this vicinity are some who are very fond of buckwheat honey, although they do not see it one year in four. Those who favor buckwheat honey seem to prefer almost any dark honey to light.

475—p. 202. It is doubtful whether there is any way in which by the investment of one dollar annually each bee-keeper can do so much to keep down adulteration and keep up the price of honey as by joining the National Bee keepers' Association

479—p. 203. It is just possible that the hexagonal form makes a more comfortable footing for the bees to walk on going in and out of the cells than if the cells were strictly circular in form.

483—p 204. It seems clear we are using foundation with less than 5 cells to the inch—in the above case, somewhere from 4 6 to 4.8 to the inch. I am not so sure that I agree with Bro. Doolittle in his comment where he thinks that, because God made the bee with an instinct to make 5 cells to the inch, A. I. Root was off in trying to make 4⅙ cells to the inch. God made the strawberry small; but we think it a rather good thing that man has so enlarged it that one tame berry will outweigh 50 wild ones. It is just possible that a larger bee might be a good thing, and larger cells might be an element in securing the same. Dr. J. P. Murdock sent me some bees of unusual size, and comb built by them, very evidently without any foundation, and the worker-cells were 4⅙ to the inch, and some of them larger.

487—p. 208. Prof. Cook is good authority, but there are authorities who are just as positive that some honey-dew is not the secretion of insects. If my memory is not at fault, have read of branches being brought into the house and secreting afresh the honey-dew when it was wiped off, there being no possibility of insects in the case.

491—p. 208. Very likely there may be a difference in localities. In this region I think honey-dew is always objectionable.

495—p. 217. Hybrids here are painted in such black colors that the novice would hardly dare to own a colony of them if he could get them for nothing. It is only fair to say that a large proportion of the bees in the apiaries of practical bee-keepers in this country are hybrids, and those bee-keepers are still alive after handling hybrids for years. Occasionally a hybrid colony is so cross as to be unendurable, and the queen of such a colony should be promptly decapitated.

[Perhaps hybrids are painted a little too black. This paragraph was written twenty odd years ago by A. I. R., just after he had had some disagreeable experience with hybrids. Since that time we know that Cyprians, Holy Lands, and Syrians leave hybrids far in the shade so far as ugliness of tember is concerned.—E. R]

499—p. 219. A very young queen needs no cage. If she has not been held in the cell by the workers, when she first emerges she will be kindly received in any colony, even one with a good laying queen. But if a laying queen is present the virgin will not continue in favor when she acquires a little age, unless the bees think of superseding the old queen.

501—p. 220. For years I've done this: When a colony shows its sense of queenlessness by starting queen-cells, no matter if the queen-cells are well advanced, I simply lift a frame out of the brood-nest and place the queen right among the bees on the brood, with no precaution or preparation whatever. So seldom is there any loss that I much prefer this plan to caging, although the plan might not work so well when honey is not coming in. Latterly I generally follow a still safer plan, original with me, but discovered by others as well. It is, to merely lift out from a nucleus the frame containing the queen, and put it, bees and all, into the queenless hive. Probably the cages are best for Mr. Root, because he receives his queens from abroad in cages.

[I have tried both plans you mention for introducing queens; but once in a great while they are both liable to fail. The failures are so few, however, that I would let any queen loose as you did, that does not cost over a dollar.—E. R.]

503—p. 221. I have freed many a balled queen by throwing the ball in water, that being the usual plan before smokers were invented. Smoke is better, but a caution is needed. If you hold the smoker close and blow very hot smoke on the ball, the queen will be promptly killed. Hold the nozzle at a distance so the smoke will come on the ball cold, then patiently blow till the bees gradually give it up.

505—r, 224. You are quite right. So is Doolittle. Bees may be extra good workers in spite of their being golden yellow. But it takes more care to take good working qualities along than it does to get the color without them, and all breeders do not take as much care as Bro. Doolittle.

[I do not agree, friend M.; that is, where you have a good strong colony in the height of the season. Such a colony, I think, could rear 100 queens, and have them just as good as if it reared only half a dozen. Even with natural swarming I have seen as many as from fifteen to twenty queens come out with an after swarm; and for experiment this after-swarm was divided up into nuclei so as to save nearly all the queens, and they all proved to be excellent.—E. R.]

515—p. 228. I have seen laying workers have the cells filled with with eggs just as regularly as a normal queen. That is only where they are strictly confined to worker-cells. Usually the first sign of laying workers is an egg in a queen-cell, eggs being scarce elsewhere. If drone-cells have two or more eggs in them, you are safe in saying, "Laying workers" A lot of eggs in a queen-cell is also sure proof

[But it is not unusual to see the egg from a laying worker deposited regularly in the cells?—E. R.]

519—p 246. When you are hitched up to go to an out-apiary, a mile or two further doesn't make much difference, and you might as well be on the safe side and have your apiaries 5 miles apart, if convenient. Then there will be no interference unless bees fly 2½ miles from home, and you know it is just possible that Bro. Doolittle may be right in saying bees fly from choice 3 miles or more.

523—p. 252. Frank Cheshire says a spur at the termination of the tibia of the middle leg, acting like a crowbar, pries the pollen-mass loose.

525—p. 252. I shouldn't wonder if it were much the same with you as with me. There is a great *show* of pollen carried in from maple and corn, and undoubtedly a great deal of it; but I suspect much more is stored from clover than from any other source, for the bees work so much longer time upon clover, although the pellets, as carried in, are not so conspicuous. Besides, the surplus pollen carried over winter is nearly all of the brown color of white-clover pollen.

531—p. 252. I may be mistaken about it, and the ground is covered with snow, so I can not refer the matter to the bees; but as memory brings the matter up before me, not more than one bee in three ever bring in pollen, and often not more than one in five or ten. Possibly they had small loads of pollen when I thought they had none.

535—p. 253. I have fed many bushels of grain to bees (generally ground corn and oats), and I would never think of feeding it on the ground. The best way I have tried is to take hive-covers, 6 or 8 inches deep, put a stone under each near the middle; and as often as the bees work down the feed, turn the cover around so as to leave the feed at the upper end.

539—p. 255. Years ago, doing just as you direct, I couldn't get my bees to touch meal; but latterly I have no difficulty, without using any honey, simply setting out the meal. The explanation is, that, with a very few colonies, they got enough natural pollen and didn't want horse-feed; now there are so many that pollen is scarce, and they are glad to get any substitute.

543—p. 271. My observation does not entirely agree with that of Bro. Doolittle. If the bees intend to send out an after-swarm, the second queen does not hatch until after the swarm leaves, as he says; but piping and quahking has been going on, one or several queens in the cells have the caps of their cells gnawed through ready to emerge, but are are kept back by the workers, and I think the free queen is also kept by the workers from these cells which she is industriously trying to enjoy. If no further swarming is intended, instead of its being "a rare thing that the second queen is allowed to hatch," it is quite a common thing with my bees, for I frequently find two or more virgins free on the combs at the same time. These queens have undoubtedly been of nearly the same age, and I must very promptly remove any that I do not want killed. Instead of saying, as in the text, that a virgin's first duty is to hunt up a queen hatched before her, I should put it a little broader, and say that "one of her first and foremost duties" is to seek out, with intent to destroy, any and every thing in the shape of a rival, whether in the shape of a hatched virgin or a virgin in the cell. I have seen them busily engaged in tearing open the cells of their royal sisters, and when two free virgins come in contact it means a fight to the finish.

547—p. 272. A peculiarity about this destroying cells I do not remember to have seen in print. If queen-cells in all stages are present, and the bees decide that no queen is desired from any of them, the unsealed cells will be found emptied of their larvæ, and the sealed cells near the maturity will be torn down; but the remaining sealed cells will be left undisturbed till near maturity.

549—p. 272. Instead of paying no attention in such instances, is it not the case that the queen tries to destroy the cells, but is hindered by the workers?

[I do not think the queen even tried to destroy the extra cells in the case I have mentioned. Once it was an observatory hive, and the whole family watched to see the queen destroy the cell; but she was never seen to pay any attention to it whatever, although she often crawled right over it.—A. I. R.]

550—p. 273. See 567 below.

553—p. 279. It is possible that, if she had been kept in a cage 24 hours before being shipped, she might have gone through safely. That would have allowed her to become relieved of her burden of eggs so that she could cling to the sides of the cage.

555—p. 280. This is true of virgin queens, but by no means so true of laying queens in the same cage, and I never saw an immediate fight. One of them would likely be dead in 24 hours, but I have known both to remain together in apparent peace for several days.

559—p. 282. One of the very difficult things is to be sure as to the character of honey from any given source, unless it be obtained from that source in very large quantity. You quote Langstroth as saying that raspberry excels wild-clover honey in flavor; while F. Greiner says, *Gleanings*, June 15, 1900, page 472: There are many extensive fields of black raspberries within reach of my bees, and these fields are fairly roaring at the time of bloom. The gain in the hives is noticeable, and sometimes sections are filled with a rather dark inferior honey."

563—p. 285. One advantage of a book over all other kinds of records is its permanence. Sometimes it is desirable to refer to a record of ten years ago. In tracing the pedigree of a queen it is useful to have permanent records, giving amount of honey from each colony, and special characteristics. Any kind of movable record kept on a hive is in danger of being disarranged, but not a book. The book I prefer is 12 inches long and 5 or 6 inches wide, three colonies to a page. It is important that there be only one sewing through the book; that is, the first leaf and the last leaf of the book are the same sheet, the second leaf and next to the last leaf are the same, and so on. Such a book, with the entries made with pencil, is not greatly damaged if left out in a rain.

567—p. 288. Perhaps more sounds are produced by the true vocal apparatus than by the wings, and perhaps more sounds are *noticed* while bees are on the wing; but if the ear be held hard against the wall of the hive, a great number and variety of sounds will be heard; in fact, a regular jabber, and the nervous novice will hear a queen piping sometimes when no queen is in the hive

571—p. 293. If the robbing is discovered in time, it is not well to allow it to continue 2 to 12 hours. Every hour the robbing continues, fresh bees join in the raid; and the longer it continues, the worse will be the excitement. A little farther back it is said that "when a colony has been almost completely robbed, it should be left alone." That is true, but it is not wise to leave any considerable amount of honey. If it is not thought best to stop the robbing by some other means, take away all, or very nearly all, the honey, so that the bees will of themselves close up the robbing as quickly as possible, *but leave the outside appearance of the hive unchanged.* If you take away the hive, the bees in their search for it will pounce upon the nearest colonies. If the hive with some empty combs is left, their continued attention will be concentrated upon this hive, and they can't figure out whether you have taken the honey or they have taken it themselves. This summer I found robbers working in full blast upon a queenless colony. I set the hive off the stand and put in its place one having the same appearance outside, but containing only empty combs and a very little honey. I put the queenless colony in a dark cellar, and gave it a queen in a cage. Three or four days later I returned the colony to its place and all was lovely, the robbers having in the mean time deserted the empty hive. Giving a queen to a queenless colony is a great encouragement to resist robbers.

575—p. 315. Quite likely, muscular action may cease in five or ten minutes, but by no means the power to make a painful wound. One winter, toward spring, my wife was cleaning wide frames, and came to me with a dried bee-sting, saying it got into her finger from a wide frame, and that it hurt. To see how far her imagination went, I thrust the sting into my hand, and there was no question about it. I experienced the genuine, simon-pure bee-sting pain—not very severe, to be sure, but unmistakable. Her pain was probably greater than mine, and I see no way that the sting could have belonged to a living bee any time within six months.

[This is indeed wonderful. I am very glad you have mentioned it, friend M., for something of the same kind has come up before, and I assured the parties they were mistaken; that the sting must have come quite recently from a live bee.—A. I. R.]

579—p. 317. One year I had about a quarter of an acre of Russian sunflower in a solid patch, which was nicely cultivated. It did not appear to be of any value to the bees; and although it will produce more quarts of seed, they are mostly shell with very little meat. I suspect the common variety is of more value.

583—p. 318. This proves nothing either way. The queen might stir the workers up to swarming pitch,

without herself leaving the hive at all. She might even do this so that this temper would continue for some time, although the queen were taken from the hive. I only say *might*, for I don't *know* any thing positively about it. There is important ground here for the A B C class to work.

587—p. 318. I once had a swarm issue from a hive in which there was no queen at all. I had taken her from the hive perhaps an hour before, and I presume the bees had not discovered her absence. In this case the queen was certainly not the direct and immediate cause of the swarm, although she may have started the fever before leaving.

591—p. 326. Too often, one hive may receive the greater share of the bees.

595—p. 326. I have less faith in this than I formerly had. When a colony gets to the point that it actually swarms, it takes considerable room to satisfy it; and the oftener it is balked in its attempts, the more determined it seems. I once had a colony swarm, and I returned the bees, giving them one or two frames of foundation. Next day they swarmed again, and I gave them another frame of foundation. Out they came the next day, and went back with another frame of foundation. When they came out again I put them back and decided to have my own way by leaving in the brood-chamber nothing but empty foundation. But their blood was up, and they came out, leaving the foundation untouched except one incipient queen-cell with an egg in it! I gave in. I hived them on a new location, and all was "lovely." Some sections of honey were on, and I think that, without these, they surely would not have swarmed the last time.

599—p. 332. If I understand it, your reasoning is that bees cluster because they don't hear the queen. Now, when a swarm issues without a queen, as when the queen is clipped, they generally do not cluster, but go back to the hive without clustering. If *not hearing* the queen in one case makes the bees cluster, why doesn't it in the other?

[Friend M., I can not answer. You must not ask such hard questions.—A. I. R.]

603—p. 335. Strings are good but I just a little prefer very fine wire such as is used for wiring frames. You can work a little more rapidly with the wire by having it cut in lengths to reach once around the frame and then have the ends twisted together. The bees can not tear it down, but it doesn't seem to be at all in their way. The first time the frame happens to be taken out, the wire can be broken apart at the twisted end by a single pull with one finger.

611—p. 336. Lay the box hive on that side which will allow the combs to stand as nearly as possible straight up and down, and not flat; for if flatwise, the combs may break down.

615—p. 346. For comb honey I would have no place for ventilation in summer except at the bottom of the hive; for extracted honey, an opening for ventilation at each story. That helps to prevent swarming.

619—p. 349. Here is an easy way to render a small quantity of wax: Take an old dripping-pan and split open one corner, or punch a hole in the bottom at one corner. Put the bits of comb in the pan, and put the pan in the oven of the cook-stove, leaving the oven-door open. Let the leaky corner of the pan project out of the oven, with a dish beneath to catch the wax, and have the end of the pan inside the oven raised to catch the wax. The heat of the stove will do the rest.

623—p. 362. I'm with Bro. Doolittle in saying, "Don't wait for snow" It might happen in this region that they would stand three or four weeks of very severe weather before the snow, and be in bad case for taking in. For some reason that I am not sure I fully understand, when bees are taken in when snowing they get badly stirred up after being brought in. If I knew enough to decide, I should take them in the next day after they have had a good flight at a time when they would have no chance to fly again for a month. That would, perhaps, be as you say, toward the last of November, but in northern Illinois it would often be earlier.

627—p. 373. While it would be a very nice thing if all cellars could be like Mr. Doolittle's, varying only four degrees, yet to hold that a variation of ten degrees unfits a cellar for bees would bar out, most likely, nine-tenths of the cellars now used for bees. However it may be at Borodino, at Marengo the mortality on summer stands may be expected to be five times as great as in a cellar varying ten degrees. I should hardly restrict as closely as our author, for I should expect bees to winter very well in a room with vegetables, if the cellar were kept as a vegetable-cellar should be kept. Still it is better to have a separate room.

[Do you not make my language more restrictive than it really is? I only recommend that there be no variation greater than ten degrees; but I do not say that bees will not winter in a cellar where there is a greater range of temperature. But in giving instructions to beginners it is well to set before them conditions as nearly ideal as possible for them to strive at: for while *you* could winter in the cellar with considerable variation of temperature, a beginner might meet with disaster.—E. R.]

631—p. 376. The advice to handle hives so carefully that none of the rest will be disturbed belongs rather to taking in than out. It matters little on taking out how much the bees are disturbed, so they do not fly out to sting or be lost before being placed on their stands. To prevent their flying out, smoke may be used as they leave the cellar, although rarely necessary. Mr. Doolittle's advice to commence setting out at 4 o'clock is good, only I should want it 4 A.M. With a considerable number to carry out, there would not be time to get all out at one job. A colony taken out when the sun is only an hour high has too short a time for flight, and the lowering temperature might cause bees to be chilled. I should expect the advantage of an opportunity for a full time for a flight to overbalance any danger from robbing.

[While it is true that it is important to handle hives carefully in putting them into the cellar, yet the book is intended to instruct beginners, and therefore urges caution in taking them out. Some timid ones might be stung while carrying out a heavy hive of bees, with the result that the whole hive would be dropped, and then—?—?—!—!—E. R.]

635—p. 376. I have had very little trouble from swarming out when bees are taken out of the cellar, but there may be cases in which the trouble amounts to disaster. E. D. Godfrey, Red Oak, Iowa, told me that one spring when his bees were taken out (I think there were more than 50 colonies), nearly all the bees deserted the hives as if by common agreement. They sailed around as a great cloud in the air, and then returned, some hives getting several colonies and some being deserted, and he went to bed sick, and no wonder.

639—p. 376. Mr. Doolittle's plan of covering the cellar floor with sawdust makes it pleasanter than to feel the dead bees crushing under one's feet at every step. But if a number of dead people were lying on my sitting room floor, I should hardly expect to keep the air sweet by sprinkling sawdust over them once a month. The advices might be combined—put half an inch of sawdust on the floor once a month, *and* sweep up two or three times a winter; but if you can do only one, let it be the sweeping.

643—p. 377. See 647.

647—p. 377. At present, October, 1900, I am not so hopeful about ever dispensing with fire in my bee-cellar. Mr. Doolittle used a stove one winter and lost his bees. But wasn't that an oil-stove, or something in that line, that he could not safely use in his sitting-room? I should expect to kill bees with an oil-stove allowing the fumes to escape in the cellar. So far as I understand the matter, *any argument against fire in a bee-cellar applies equally against fire in a sitting-room.* Of course you can do harm with fire in a cellar; so you can in a sitting-room. If the temperature of a cellar be only half a degree below that which is best for the health of the bees, then I think fire enough to hold the temperature at the right point will do less harm than to allow the bees to endure that half-degree of cold. But I should not want to use an oil stove, a lamp, or any thing of the kind that would vitiate the air. If I couldn't have a decent stove, the same as would be considered fit for a room for human beings, I would use something like hot stones or jugs of hot water *corked tight.*

[If it were not for your advocacy of artificial heat in cellars I believe bee-keepers over the country generally would consider the use of stoves in winter repositories as worse than useless; but after years and years of careful observation you are probably right for your locality and your conditions in believing that artificial heat is an advantage.—E. R.]

655—p. 380. Like many others I have found that two or more "dwindlers" united last no longer than one separately, so I never unite unless I am pretty sure a queen will otherwise be lost. The queens of those colonies too weak to retain them are put in cages under the quilt over the brood-frames of a strong colony. This colony may lose its own queen by the operation, but the caged queens will be kept in good shape till needed for new colonies.

Biographies of Noted Bee-keepers.

Biographies of Noted Bee-Keepers.

Believing that many of the A B C scholars would be interested in seeing the portraits, and in reading the biographical sketches of some of the prominent bee-men—men who have distinguished themselves in the line of apiculture—it is with no little pleasure that I now introduce them to you as far as it is possible to do so on paper. Dr. Miller, who, by reason of his natural fitness for the task, and who for long years has been more or less acquainted with the writings and doing of these men, has been detailed to write some of the sketches. The others are condensed from longer sketches that appeared in GLEANINGS IN BEE CULTURE. The portraits, executed by the half-tone direct process of engraving, are, from the nature of the process, true to life, and have been so pronounced by those intimately acquainted with the subjects. Most of the wood-cuts are good.

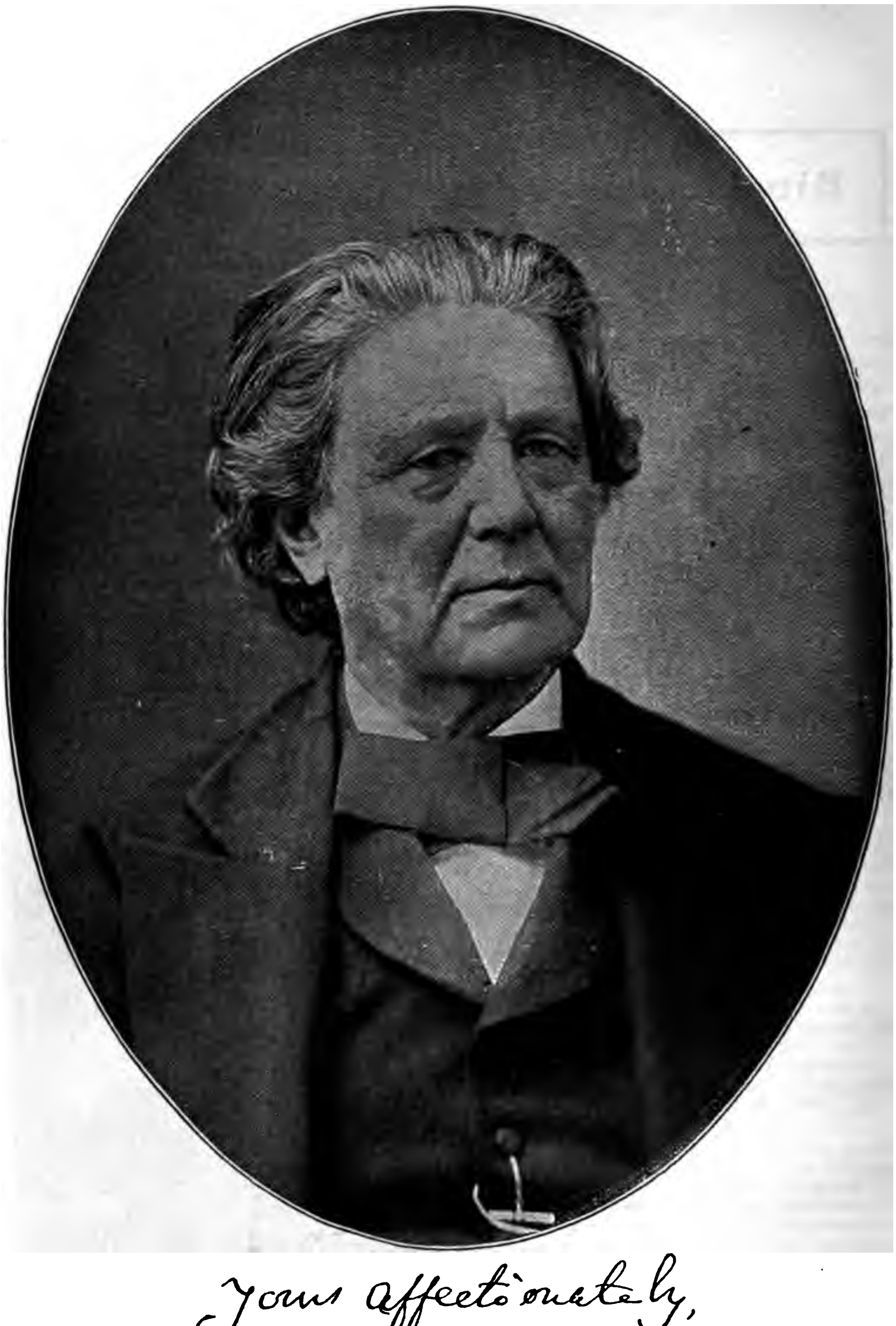
LORENZO LORRAINE LANGSTROTH.

Lorenzo Lorraine Langstroth was born in Philadelphia, Pa., Dec. 25, 1810. He graduated at Yale College in 1831, in which college he was tutor of mathematics from 1834 to 1836. After his graduation he pursued a theological course of study, and in May, 1836, became pastor of the Second Congregational Church in Andover, Mass., which position ill health compelled him to resign in 1838. He was principal of the Abbott Female Academy, in Andover, in 1838-9, and in 1839 removed to Greenfield, Mass., where he was principal of the High School for Young Ladies, from 1839 to 1844. In 1844 he became pastor of the Second Congregational Church in Greenfield; and after four years of labor here, ill health compelled his resignation. In 1848 he removed to Philadelphia, where he was principal of a school for young ladies from 1848 to 1852. In 1852 he returned to Greenfield; removed to Oxford, O., in 1858, and to Dayton, O., in 1887.

At an early age the boy Lorenzo showed a fondness for the study of insect-life; but "idle habits" in that direction were not encouraged by his matter-of-fact parents. In 1838 began his real interest in the honey-bee, when he purchased two stocks. No such helps existed then as now, the first bee-journal in America being issued more than twenty years later, and Mr. Langstroth at that time had never heard of a book on bee culture; but before the second year of his bee-keeping he did meet with one, the author of which doubted the existence of a queen! But the study of bees fascinated him, and gave him the needed outdoor recreation while engaged in literary pursuits, and in the course of time he became possessed with the idea that it might be possible to so construct a hive that its contents in every part might be *easily* examined. He tried what had been invented in this direction, bars, slats, and the "leaf hive" of Huber. None of these, however, were satisfactory, and at length he conceived the idea of surrounding each comb with a frame of wood entirely detached from the walls of the hive, leaving at all parts, except the points of support, space enough between the frame and the hive for the passage of the bees. In 1852 the invention of the movable-comb hive was completed and the hive was patented Oct. 5 of that year.

LORENZO LORRAINE LANGSTROTH AT 80.

It is well known that, among the very many hives in use, no other make is more popular than the Langstroth, but it may not be so well known



Yours affectionately,
L. L. Langstroth.

that, in a very important sense, every hive in use among intelligent bee-keepers is a Langstroth; that is, it contains the most important feature of the Langstroth—the movable comb. Those who have entered the field of apiculture within a few years may faintly imagine but can hardly realize what bee-keeping would be to-day, if, throughout the world, in every bee-hive, the combs should suddenly become immovably fixed, never again to be taken out of the hive, only as they were broken or cut out. Yet exactly that condition of affairs existed through all the centuries of bee-keeping up to the time when, to take out every comb and return again to the hive without injury to the colony, was made possible by the inventive genius of Mr. Langstroth.

As a writer, M. Langstroth took a high place. "Langstroth on the Hive and Honey-bee," published in May, 1853, is considered a classic; and any contribution from the pen of its author to the columns of the bee-journals was read with eagerness. Instead of amassing the fortune one would think he so richly deserved, Mr. Langstroth died not worth a dollar. He sowed, others reaped. At the date of his invention he had about twenty colonies of bees, and never exceeded 125.

In August, 1836, Mr. Langstroth was married to Miss Anna M. Tucker, who died in January, 1873. He had three children. The oldest, a son, died of consumption, contracted in the army. Two daughters still survive.

After his twentieth year, Mr. Langstroth suffered from severe attacks of "head trouble" of a strange and distressing character. During these attacks, which lasted from six months to more than a year (in one case two years), he was unable to write or even converse, and he viewed with aversion any reference to those subjects which particularly delighted him at other times. Mr. Langstroth was a man of fine presence, simple and unostentatious in manner, cheerful, courteous, and a charming conversationalist.

The father of American bee-keeping has left the scenes of his labor. His death was entirely in keeping with his holy life. While administering the Lord's supper on Sunday morning, Oct. 6, 1895, in his place of worship, in Dayton, O., he died in his chair, without any previous warning. His last words were concerning the goodness of God, and were a fitting termination to one of the most exemplary and useful lives this world ever produced.

Although six years have passed since the death of father Langstroth, his impressive personality still lingers among us, inciting us, by the recollection of his struggles, to the attainment of a higher life.

MOSES QUINBY.

Moses Quinby was born April 16, 1810, in Westchester Co., N. Y. While a boy he went to Greene Co., and in 1853 from thence to St. Johnsville, Montgomery Co., N. Y., where he remained till the time of his death, May 27, 1875.

Mr. Quinby was reared among Quakers, and from his earliest years was ever the same cordial, straightforward, and earnest person. He had no special advantages in the way of obtaining an education, but he was an original thinker, and of that investigating turn of mind which is always sure to educate itself, even without books or schools. When about twenty years old he secured for the first time, as his own individual possession, sufficient capital to invest in a stock of bees, and no doubt felt enthusiastic in looking forward hopefully to a good run of "luck" in the way of swarms, so that he could soon "take up" some by the aid of the brimstone-pit. But "killing the goose that laid the golden egg" did not commend itself to his better judgment, and he was not slow to adopt the better way of placing boxes on the top of the hive, with holes for the ascent of the bees, and these boxes he improved by substituting glass for wood in the sides, thus making a long stride in the matter of the appearance of the marketable product. With little outside help, but with plenty of unexplored territory, his investigating mind had plenty of scope for operation, and he made a diligent study of bees and their habits. All the books he could obtain were earnestly studied, and everything taught therein carefully tested. The many crudities and inaccuracies contained in

MOSES QUINBY.

them were sifted out as chaff, and after 17 years' practical experience in handling and studying the bees themselves as well as the books, he was not merely a bee-keeper but a bee-master; and with that philanthropic character which made him always willing to impart to others, he decided to give them, at the expense of a few hours' reading, what had cost him years to obtain, and in 18[illegible]; the first edition of "Mysteries of Bee-keeping Explained" made its appearance. Thoroughly practical in character and vigorous in style, it at once won its way to popularity. From the year 1853, excepting the interest he took in his fruits and his trout-pond, his attention was wholly given to bees, and he was owner or half-owner of from 600 to 1200 colonies, raising large crops of honey. On the advent of the movable frame and Italian bees, they were at once adopted by him, and in 1

reduced the number of his colonies, and turned his attention more particularly to rearing and selling his Italian bees and queens. In 1865 he published a revised edition of his book, giving therein the added experience of 12 years. He wrote much for agricultural and other papers, his writings being always of the same sensible and practical character. The Northeastern Bee-keepers' Association, a body whose deliberations have always been of importance, owed its origin to Mr. Quinby, who was for years its honored president—perhaps it is better to say its *honoring* president, for it was no little honor, even to so important a society, to have such a man as president. In 1871 Mr. Quinby was president of the N. A. B. K. A.

It is not at all impossible that the fact that so many intelligent bee-keepers are found in New York is largely due to there being such a man as Mr. Quinby in their midst. The high reverence in which he was always held by the bee-keepers, particularly those who knew him best, says much, not only for the bee-master, but for the man.

On the occasion of the first meeting of the Northeastern Society, after the death of Mr. Quinby, Capt. J. E. Hetherington said, in his address, in a well-merited eulogium on Mr. Quinby: "Of the great amount of gratuitous labor performed by him, to advance the science of bee culture, the fraternity as a whole will never know, nor can they realize the information imparted to the numbers who flocked to see him personally, especially in the busy season. . . . .

"His life has been in every sense a life of usefulness and not wholly devoted to the interests of bee culture, for he took a living interest in any movement he thought would benefit society: and as an advocate and helper in the temperance work he did no mean service. He possessed true kindness of heart, and regarded it as a religious duty to make all better and happier with whom he came in contact, and regarded that life a failure that did not leave the world the better for having lived."

DR. JOHN DZIERZON.

Probably few readers of English have come across this name for the first time without stopping to look at it in order to ascertain what to call it. The Germans have had the same difficulty, and got around it by calling it Tseer-tsone; and as this pronunciation is pretty well established, perhaps it would be well to stick to it. There is little doubt, however, that it should be looked at from a Polish standpoint, and called Jeer-zone. As a considerable part of this book is taken up in the explanation of the genesis of the bee, and as this necessarily involves the theory which has made this man famous for all time, more as a naturalist than as a bee-keeper, I will not stop to dwell on what is now called the Dzierzon theory—a theory so well established that it is no theory at all, more than is the rotundity of the earth.

This eminent man was born in Lokowitz, Upper Silesia, Jan. 16, 1811, just three weeks after the birth of Mr. Langstroth. Thus we see these two great lives starting out like two rivers at the same time, and running nearly parallel with each other for 85 years, each a worthy example for all time to come. Dr. Dzierzon, like Mr. Langstroth, showed, showed from his earliest youth a great love for the works of nature; and the most interesting of all things to him was the observation of the habits of bees, his father keeping a few in log skeps. He early manifested a deeply religious turn of mind, which his father cultivated with care, sending him to the public school at Pitschen.

In order to have more time and means to pursue this branch of natural history, Dr. Dzierzon chose the clerical profession, and here again is a remarkable similarity to the career of Langstroth.

The hives in vogue when Dr. Dzierzon was a boy were simply four-sided boxes, and with them he began apiculture in earnest in 1835, just as he began his pastorate in Karlsmarkt. He was not slow to discover the gross defects of such hives, and the first thing he did was to devise a straw cover which would not allow so much moisture to be precipitated as was the case with hives covered with boards alone. To quote a German writer, "In order that this straw cap might be lifted off without injury to the combs he put on as many inch-

DR. JOHN DZIERZON.

wide bars, spaced a finger-breadth apart, as were required to cover the hive. This being done, and the bees, having built regularly to these bars, he fastened to each bar a piece of comb saved from old hives. This was the first step toward the invention of movable combs, for thereby was the master enabled to remove from the hive each individual comb."

The idea of the mobility of frames being established, Dr. Dzierzon gave himself no rest in his desire to unlock the inner mysteries of the hive; and while working with the bees he cast a glance at them whenever he could. "By this research many other mysteries were cleared up—pre-eminent among which was one that revolutionized the teachings in natural history in certain classes of zoology." In establishing this theory, the Italian bee was the chief factor, its color itself forming a proof of the theory. Like most truths, the [illegible]

trary of which has been held, this theory met with great opposition; but it was finally settled for all time by an appeal to the dissecting-knife and microscope. Dr. Dzierzon's triumph was so complete that he was soon decorated with medals of honor from different potentates and associations; but his natural modesty prompts him rather to conceal them than to display them.

The last we heard concerning this great naturalist was that he still enjoyed a happy old age in the full possession of all his faculties.—*W. P. Root.*

FRANCIS HUBER.

(In view of the many animated discussions that have been held in regard to the benefits arising from Huber's investigations, we deem it no more than fair to state that his efforts, as the writer of the article suggests, were directed mainly toward the habits of the bee rather than toward any particular method of securing large amounts of honey; but his labors, nevertheless, will always be held in very high esteem by the world at large. The sketch below was written in the German language by Mr. T. Kellen, of Luxemburg, and first appeared in Gravenhorst's *Illustrated Bee Journal.*—ED.)

Francis Huber, by his investigations and researches in apiculture, did more to promote that science than all his predecessors who had employed themselves in the study of this interesting insect. It was his discoveries alone that marked that golden age in the history of apiculture which is destined to remain for all ages. Huber's observations are not only of the greatest importance of themselves, but wonderful for the manner in which they were all made; for Huber was blind.

This distinguished man was born in Geneva, July 2, 1750. He was the son of a prosperous and respectable family, which as early as the 17th century were celebrated for their knowledge of the arts and sciences. His father, John Huber (born in 1722, died in 1790), was well known on account of his attachment to the celebrated French philosopher Voltaire.

From his earliest youth Huber showed a passionate predilection for natural history, and he applied himself to study with such zeal as to endanger his health, so that at the age of fifteen the reflection of glary snow destroyed his sight. If ever a man bitterly deplored the loss of eyesight, that man was Huber. But his misfortune did not hinder him from applying himself to the study of those insects for which he had an especial liking; namely, the bees. It was this little insect that turned the darkness of the investigator into day; for Huber was the first to see clearly into that domain which to the best eyes had previously remained in darkness.

Huber did not lose his vigor of mind, for he went forward in the study of bees; but he could do this only by the help of his wife, Marie Aimie Lullin; his niece, Miss Jurine, and, above all, his servant Burnens. He himself manifested the most untiring perseverance and the greatest ingenuity, so that, by Burnens' sagacity, all of Huber's experiments with bees were practically demonstrated. Miss Jurine, who loved natural history above all else, supplemented Huber's work all she could, fearing not to take up the dissecting-knife and microscope in his aid. She was the first after Swammerdam to demonstrate that worker-bees are females. She it was, too, who, with Huber, established the principles on which the sages of our century grounded the doctrine of parthenogenesis. Besides that, Miss Jurine was Huber's secretary, full of willingness and self-devotion. Every day she noted down the results of the new investigations, and she also wrote the letters which Huber dictated to Charles Bonnet and his friends, and imparted to him the results of his labors, and directed their attention to numerous questions relating to bees

Huber's interest in bees was greatly enhanced by the researches and writings of Swammerdam, Reaumur, Schirach, and probably also of the celebrated Swiss bee-keeper Duchet de Remauffens, and the Messrs. Gelieu. As a conclusion to the investigations of these men, it was possible for him, in spite of his unfortunate surroundings, to add greatly to the realm of apiculture; hence we may not forget that he everywhere encouraged and helped others by the nobility of his life.

In his later days he lived retired, but in peace, at Lausanne, where he died, Dec. 22, 1831, aged 81 years.

FRANCIS HUBER.

Huber's discoveries are known to scholars through his Letters to Charles Bonnet; and they made his name so celebrated in all Europe, and even in America, that for many years he was recognized as the greatest apicultural genius; and even yet Mr. Hamet calls him the greatest of the lovers of bees (*le plus grand des apiphiles*). It was in 1796 that his first epoch-making work was brought to light, bearing the title, *Nouvelles Observations sur les Abeilles* (New Observations on Bees). His son, Peter Huber, in 1814, published the work in two editions, and added thereto an appendix in regard to the origin of wax.

Huber's work is, not only on account of its contents, but for the peculiar circumstances under which it was first brought to light, entirely without parallel in scientific literature. The recognition it received was universal, so that, after the first appearance of the work, Huber was received into the French Academy of Sciences and other scientific bodies.

The New Observations was translated early into every European tongue. The Saxon commissariat Reim, in Dresden, translated it into German in 1798, and Pastor Kleine, of Luethorst, translated it again in 1856, and published another edition in 1869, with notes.

Huber, by his observations on the secrets of bee-life, made clear what the most sagacious and learned observers from the time of Aristotle and Aristomachus down to Swammerdam and Reaumur had sought for in vain; and it is to be the more regetted that some German bee-keepers of great influence, such as, for instance, Spitzner and Matuschka, gave him no recognition.

He gave interesting explanations in regard to the habits of bees, their respiration, the origin of wax, the construction of comb, etc. He confirmed Schirach's proposition, that, by a change in the mode of treatment and food of larval bees, queens could be reared from worker eggs, and showed, likewise, the influence which the cell exerts on the insect. He showed further, that not only the queen but a certain species of worker-bee could lay fertile eggs, and showed, likewise, the function of drones. In opposition to Braw, Hattorf, Contardi, Reaumur, and others, who held very peculiar opinions in regard to the fertilization of queens, Huber showed that the fertilization takes place outside of the hive, at the same time that drones are flying, and that the union is effected in the air, and that the queen, on her return from the flight, has adhering to her body the evidences of fertilization, and that egg-laying takes place in about 46 hours afterward. These and numerous other experiments he often proved in his works with the utmost exactness; and especially did he lay down the most important and interesting information in regard to feeding bees, their method of building, the leaf-hive, foul brood, etc., in his letters to an eminent apiculturist in Switzerland, Mr. C. F. P. Dubied. These eighteen very long letters of Huber, the first of which was dated Oct. 12, 1800, and the last Aug. 12, 1814, were written partly by Huber himself, partly by his wife or daughter, to whom he dictated. So far as I know, this correspondence has never been translated into German.

ADAM GRIMM.

Adam Grimm was born in Germany in 1824. His father kept a few hives of bees, in which Adam took deep interest, and did not rest satisfied till he himself became the owner of a few colonies. He emigrated to this country in 1849, settling at Jefferson, Wis., on a farm where he remained until his death, which occurred April 10, 1876. Soon after settling at Jefferson he obtained a few colonies of bees, and was so successful with them that at one time, when all other crops failed, his bees came to the rescue and helped him over the most critical time of his life.

In 1863 he had increased his apiary to sixty stocks of black bees in all sorts of box hives, and in 1864 he commenced to use frame hives, and transferred all his bees into them. In the same year, 1864, he bought his first Italians, and, as rapidly as possible, Italianized his apiary, and then sold large numbers of Italian queens all over the country.

About 1869 or '70 he imported, personally, 100 Italian queens, 60 of which were alive on their arrival at New York. Of this number he introduced 40 in his own apiaries. He increased his stock regardless of cost, every year, but had larger returns, especially in late years, both from the sale of honey and bees. Queen-rearing he thought unprofitable. He had an intense enthusiasm in the business, and worked so hard in the apiary as probably to shorten his life. His success was the cause of many others engaging in the business.

He established a bank at Jefferson, of which he was cashier (his bees having provided the capital); but during the honey harvest he left his bank to the care of employees and went from one apiary to another, personally supervising all that was done.

ADAM GRIMM.

We shall not soon forget two or three pleasant visits which we made at his home, with his interesting family. He told us that his wife remonstrated with him for working so hard, telling him that he now had a competence, and could give up his bees with the laborious care of so many; but he seemed to think the returns were large for the amount of labor, making the work still a pleasure, although no longer a necessity. He reached the number of 1400 colonies; and on one of our visits, when he had nearly 1000 colonies, he said, with a half-comical expression, "What would I do if all should die in the winter?" And then the comical look giving away to one of determination, he said, "I would buy some more; and with so many hives full of empty comb I would show you how soon I would fill them up again."

His daughters, Katie and Maggie (both since married), were his able and faithful assistants; and the son, George, since his father's death, has assumed the principal care of the bees, for which he is well fitted by his previous training.

Mr. Grimm was trim built, of medium size, pleasant in manner, but especially impressing one as of great earnestness. He was very methodical, and kept an exact account of his business, showing, in a single year, $10,000 as a result of his bee-keeping.

JOHN S. HARBISON.

Mr. John S. Harbison, who, since the year 1857, has had such a prominent place in the apicultural

ranks, and an especial prominence in developing the honey resources of California, now resides in an elegant home in San Diego, and with beautiful surroundings, such as only this favored clime can produce. He was born in Beaver Co., Pa., Sept. 29, 1826. He is a thorough American, and traces his lineage back through several generations.

Mr. Harbison's early life was spent upon a farm; and his father, being an extensive bee-keeper, in the old-fashioned way, with log gums and straw skeps, the son became familiar with the buzz and industry of the honey-bee early in life, and imbibed a love for them.

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greater portion of that time; but of late years I believe he does not keep quite so many. In the meantime, W. L. Coggshall has been increasing his number until he now has 3200. Whether he is at the present time the most extensive bee-keeper in the world is not important; but certain it is that Capt. Hetherington has been a very unique figure—not because his writings have appeared in all the bee-journals, nor because he has attended all the conventions, for he has written but rarely and attended but few meetings, but

CAPT. J. E. HETHERINGTON.

because he managed successfully 3000 colonies for over twenty years, and because he introduced many valuable improvements — improvements which, after the lapse of many years, were finally adopted and put into current use by bee-keepers all over the United States.

The captain has not followed in the beaten track of supply manufacturers by any means; but he acknowledges with considerable pleasure that Father Quinby did more to help him in his early bee-keeping experience than any other man; and it was the Quinby system of hives and brood-frames which he adopted and subsequently improved. At one time the captain had nearly all his bees on the Hetherington-Quinby frame—a frame having closed ends or closed uprights; but now, if I am correct, his colonies are divided on Quinby and what is known as the Van Deusen metal-corner, open-end frame. For colder climates, I believe the captain prefers the closed ends; but in the apiaries of Virginia he uses, as a matter of preference, the open-end Van Deusen.

I need not dwell here particularly upon his record as a soldier any more than to state that he was captain of a company of sharp-shooters in the Civil War—a position that means a great deal more than to be captain of an ordinary company of infantry. Three times he was wounded, and finally was discharged on account of the disability from his wounds. At the close of the Gettysburg campaign his name was sent up to the War Department as one who had rendered gallant service for his country.

But it is of his record as a bee-keeper that I wish to speak more particularly. It may not be generally known, but he was the originator of the no-drip shipping-case that is now used almost universally throughout all civilized beedom. When we first introduced this case five years ago, it was brought to the attention of manufacturers by the commission-houses, who urged upon them the importance of making their cases on the no-drip plan.

Almost in the same way the tall section came into prominence. Where it came from, no one seemed to know; but Mr. Danzenbaker, when he called at Medina, said he first saw them at the Centennial at Philadelphia in '76, filled with beautiful combs. He subsequently learned that it was the honey of Capt. Hetherington. That the captain was the first to introduce it, there can be no question, for all the evidence points that way.

Mr. Hetherington was the first to make a really practical thing of closed-end frames. True it is that Mr. Quinby invented them, and came very near adding to them their finishing touches. But as Mr. Quinby originally used them in his particular form of hive, the frames were by no means

CAPT. HETHERINGTON DURING WAR TIMES.

as easily handled as in the particular form used by Capt. Hetherington; and from this originated the Hetherington-Quinby frame and hive that are used so much in certain sections of New York.

In these latter days, when the matter of transparency in foundation is so highly prized, it may be well to remember that Mr. Hetherington was

probably the first to get out what was really the first transparent foundation. Those of us who bought the Vandeusen flat-bottom article years ago will remember how beautiful and transparent it was, and that nothing has been made of late years that was any clearer or more beautiful. Whether it had the same pliable qualities that are found in the Weed transparent foundation I can not say.

It was Capt. Hetherington also, I believe, who first conceived the idea of incorporating fine wire into the foundation itself. A patent was granted, and for years the Vandeusens made what was called their wired flat-bottom foundation under royalty from Mr. Hetherington.

In the matter of fishbone in comb honey, it was Capt. Hetherington who first saw the importance of reducing the amount of wax in the base and putting as much as possible in the wall. We have talked a good deal about this of late, but really Mr. Hetherington was ahead of all of us in this.

Super springs, not the exact form we are using today perhaps, but a device for applying a *yielding* pressure on sections while in the super, were the invention of Capt. J. E. Hetherington—at least he used them away back in 1872, and has used them continuously till this time. This one fact alone speaks volumes for their practicability; and it is strange that we of these latter days did not discover their value sooner.—*E. R. Root.*

JULIUS HOFFMAN

Julius Hoffman, the inventor of the frame bearing his name, and which has a wide sale throughout the United States, was born in Grottkau, province of Silesia, Prussia, Oct. 25, 1838, only a few miles from where Dr. Dzierzon spent some of the best portion of his life among the bees. Indeed when a young man he visited the doctor and from this great bee-master he learned much. No wonder with such a Gamaliel for an instructor the name Hoffman has come to be known in almost every bee-man's home.

In 1862 Mr. Hoffman left his native country and settled in London, England. Four years later he came to America, settling in Brooklyn, N. Y., where he accepted employment in the organ and piano business, but bees he had to have, for his heart and soul were in the bee business. As there was hardly room in such a crowded city to keep many bees, he moved to Fort Plain, N. Y., where he settled in the spring of 1873. In a few years he had increased his stock of bees up to 400 colonies. At the time of the writer's visit in 1890 at his home he had something over 700, all of them on Hoffman frames, and in his quiet way had used them for ten or twelve years. He told me that, with these frames, he could handle two or three times as many colonies, with the same labor, as he could on the old-style unspaced Langstroth frames, and by way of proof he showed how he could handle such frames in lots of twos, threes, and fours, picking them all up at once; how he could slide them from one side of the hive to the other; how easily he could handle his colonies in halves or quarters instead of one frame at a time.

At this time (1890) nothing but the unspaced Langstroth frame was used by modern bee-keepers, except, perhaps, the closed-end Quinby in certain portions of New York; and the idea of a self-spacing frame seemed to be utterly impracticable in the mind of the average bee-keeper; but so thoroughly impressed was I with the importance and the value of the Hoffman self-spacing frame as a labor-saver that I came home and wrote it up for our journal, *Gleanings in Bee Culture.* We soon adopted it in our yards; and my own personal experience with it showed it could be handled rapidly and easily; and that for many operations in the apiary much valuable time could be

JULIUS HOFFMAN.

saved with it over the handling of the old-style unspaced frames. The bee-keeping world, not sharing in my enthusiasm, took hold of the Hoffman slowly at first; but now, 1902, twelve years later, it has come to be the leader in nearly all the hives put out by the principal manufacturers of the United States. For particulars regarding the Hoffman frame, see Fixed Frames and Hive-making. It should be stated, perhaps, that while the Hoffman frame of today differs in detail from the original frame the main self-spacing feature has been retained.

Mr. Hoffman is still a bee-keeper of some prominence, carrying on the business in a quiet way, seldom writing for any of the journals.

W. L. COGGSHALL.

W. L. Coggshall owns and operates—well, he does not know exactly how many, but somewhere from 3000 to 3200 colonies. These are distributed among some fifteen different yards, the furthest one being something like 40 miles from the home apiary. They are scattered among the hills between Lakes Cayuga and Skaneateles, and hardly a better location for such extensive bee-keeping could be found in the whole State. He also has yards in Arizona, Colorado, and Cuba. His brother, David C., formerly his partner in business, now owns something like 600 colonies, and the two

have covered almost all the territory between the two lakes with apiaries that range from two to three miles apart.

There is probably no man in the world who secures as large a number of pounds of honey per colony, with as little labor, as W. L. Coggshall. Indeed, his record and that of his helpers in extracting is something phenomenal. An extracting-house, extractor, and all other appurtenances, are stationed at each yard; and it is the custom for Mr. Coggshall to take with him two or three men, also a load of kegs, barrels, and half-barrels. Arriving at the yard, they don their armor-proof bee-suits, because no ordinary sting-proof clothing would answer. They then proceed to extract, not after the orthodox fashion, but in a manner that would make the hair of an average bee-keeper stand on end. The hives are ripped open—yes, even kicked open sometimes if a kick will do it more quickly—smoke is driven down between the frames, combs are jerked out, and with a peculiar nervous trembling motion, which they have acquired, they will shake the bees almost entirely off. What few may remain are cleaned off the combs with one or two sweeps of a long whisk-

W. L. COGGSHALL.

broom which the apiarist has tied to his person. The air may be filled with stinging bees, but that makes no difference; the work goes on just the same. The combs, as fast as cleaned, are set down in the regular hive-supers placed on a hand-cart. As soon as four supers are filled with combs, one of the boys draws the hand-cart to the extracting house where the combs are uncapped and extracted at a speed that defies competition. One of Coggshall's "lightning operators" and two boys actually took from the hives one afternoon 1400 lbs. of honey in an hour and a quarter, or at the rate of over 1000 lbs. an hour. This included taking combs out of the hive, brushing bees off, uncapping, extracting, putting the honey into kegs, and replacing the combs. This record is the more remarkable from the fact that a non-reversible extractor was used and that the "operator" is of light build, and the boys both under 16. Some of the other records are, 900 lbs. in one hour for two men; and 2500 lbs. in a day for one operator and two boys.

Mr. Coggshall places the locality first, the man second, hives last. That he thoroughly believes in this is attested by the fact that he has one of the finest locations in the world, right in the heart of the great buckwheat country, so famous for its immense crops, and by the further fact that he himself is an alert, keen business man, ever active, always studying the shortest cuts, and ever watchful of the latest methods. His hives—well, the less said about them the better. They are anything and everything, but generally of the eight frame Langstroth type—such hives as he has been able to buy up from his less successful neighbors who tried their hand at keeping bees and did not make them pay. He will take these same bees and the same hives in the same location, and make them return to him a big revenue, thus proving that there is something besides locality in getting honey.

Mr. Coggshall is, in some ways, the most remarkable bee-keeper in the United States. While the majority of us feel that we could not afford to use the hives and methods (the kicking and the stinging) employed by him, yet there is no denying the fact that he produces great results in spite of the stings, and in spite of robbing and the home-made equipments that he makes for himself.—*E. R. Root, in Gleanings for Dec. 1, 1899.*

J. F. McINTYRE.

J. F. McIntyre was born Nov. 1, 1857, in Ontario, Can., eight miles from Brantford. Like many other sterling sons of toil he was raised on a farm, going to school in winter, and helping to do the farmwork in summer. He was the oldest son in a family of three sons and three daughters. He was of an investigating turn of mind, and liked gardening, but farming he detested. His father did not keep bees, but his neighbors did. Interested and charmed by what he saw of them, at the age of fifteen, with a capital of $12.00, he made a start, $7.00 of which he invested in a colony of bees. Later he saw advertised the bee-books of Quinby and Langstroth. The former he purchased because it explained the *mysteries*, and very soon he constructed a movable-comb hive—the first one he ever saw. He afterward came into possession of Cook's Manual and this book, and subscribed for *Gleanings in Bee Culture* and the *American Bee Journal*. He then bought a honey-extractor. With this he took, on an average, 150 lbs. of honey per colony from his apiary. As has happened to many other growing and successful bee-keepers, it set the neighborhood wild. They all wanted to embark in the business. So many, in fact, went into it that it ruined his location.

Some articles which he saw in our journal and in the *American Bee Journal*, particularly some from E. Gallup, caused him to make up his mind that California was the place for a man who desired to make the culture of bees a *specialty;* and on the 7th of December, 1881, he bade good-by to

his relatives and friends, and started for the land of gold and honey, but not, he says, without some regret on his part as he looked back and saw his mother standing in the door, with her handkerchief to her eyes. He reached Los Angeles, and was just in time to attend a session of a bee-keepers' convention there. Here he met a large number of old pioneer bee-keepers, who, he says, running over with hospitality, made him an honorary member of the association. He had been in-

J. F. M'INTYRE.

formed that Mr. Gallup wished to sell an apiary of 70 colonies in Ventura. Cal. This, with another apiary of 40 colonies, he purchased. He built a small house on government land, and for two seasons he kept "bachelor's hall." The first season, he says, was not a very good one, but he made nearly $800.00. In the meantime he formed the acquaintance of R. Wilkin, who, the next year, desired him to work for him for two months. Now, Mr. Wilkin had a daughter, Miss Hattie, who, naturally enough, was a bee-keeper herself. It is not necessary to tell the rest; enough to say, that, following in the wake of many another bee-keeper, he found a helpmate among the bees. In 1886, Mr. McIntyre, and his wife to help, took 42,000 lbs. from 240 colonies, the proceeds of which were sold for $2000 cash. Two years later Mr. Wilkin sold 200 colonies in Sespe Apiary to Mr. L. E. Mercer, and moved the rest to his home apiary in Ventura, leaving his old location to his son-in-law. He bought up bees in the vicinity, and made it his home apiary. He had 150 colonies on the government claim, three miles distant, for an out-apiary, which was run during the seasons of 1888 and '89 by Mr. R. A. Holley, who has since bought it. Mr. McIntyre has now 500 colonies on the old Wilkin place, on Sespe Creek. He says it is all his location will stand. It seems remarkable that any location in the United States can stand that much. From this we get some idea of the vast nectar resources of some of the California locations. Mr. McIntyre does all the work with the bees himself, with the exception of a man in the honey-house, to extract. Mrs. McIntyre does not find time to work in the apiary, her time being taken up with family duties.

Mr. McIntyre has the honor of being the first-appointed foul-brood inspector in his county. In October, 1884, invested with proper authority, he cleared the county of about 300 diseased colonies. Two whole apiaries were found rotten with the disease. Both of these apiaries were burned. The county is now said to be almost free from the disease.—*Gleanings in Bee Culture, July* 1, 1890.

M. H. MENDLESON.

M. H. Mendleson was born in Kerhonkson, Ulster Co., N. Y., Feb. 22, 1853. His parents were German. His maternal grandfather was a Christian, but his other grandparents were Jews. Mr. M., however, is not an adherent of the latter faith. In speaking of his mother he says: "I had a noble mother, of a good education, who gave me a good moral training." His father was extensively engaged in mercantile business, farming, etc.

In his personal habits he is abstemious to the last degree, using no intoxicants of any kind, nor tobacco, abhorring the use of either.

M. H. MENDLESON.

In 1869 his father took two colonies of bees, in box hives, on a store debt. But the father, thinking any further fussing with bees an unprofitable piece of work, refused to help his son further. But the "bee fever" had already taken a firm hold on him, and from this time on he began a course which has now placed him among the most prominent of the bee-keepers of America.

His first honey was sold at from 25 to 30 cts. per lb., in 2-lb. sections, and extracted at 20 cts. He says that, by following our advice, he has always wintered successfully in chaff. His California fever was brought on by reading about R. Wilkin's crop of 48,000 lbs. in 1878. The next year, 1879, was a poor one in California. In 1880 Mr. Mendleson started for that State on his birthday, Feb. 22d. Leaving snow and mud in New York, and finding peaches and almonds in bloom in Sacramento, Cal., in March, he was greatly pleased with the change. He then took a steamer for Ventura, arriving there three days later. At the door he met R. Wilkin, whom he found to be a very intelligent and agreeable man. Mrs. Wilkin made the traveler welcome, and was to him as a mother from the first. Everything around the place was orderly and neat—hives painted, and arranged in square piles. The work was all arranged in advance, in order to avoid any delays. Mr. Wilkin's crop for 1880 was 48.000 lbs., and was sold to a firm in Liverpool, England. In order to keep all hands busy during the winter, Mr. Wilkin purchased machinery for making one, two, and ten pound cans, and at this work Mr Mendleson was put. After a good many drawbacks, and with the help of an old tinner, they succeeded in making very good cans. After getting the trick of soldering well learned, he taught Mr. J. F. McIntyre how to handle the irons. At Ventura he dipped both ends of over 3000 cans in a day—several hundred more than had been dipped at Mr. Wilkin's.

In 1882 Mr. Mendleson bought an apiary in partnership with one of the largest honey-producers on the Newhall ranch. Two seasons later he sold out and went to Ventura, and had a good position during the winter. In 1884 he bought an apiary at Coleta, 40 miles from his present residence. Moving the bees to his own county he extracted 17,000 lbs., selling it at 6 and 7 cts., while his neighbors at Ventura had to sell at 3 and 4 cts. He then moved that apiary on to "the Avenue." The year 1885 was a poor one. In 1886 he extracted 17,000 lbs. A stinging mania now seized his bees, they stinging every moving object in sight. Even fence posts were stung. This made it necessary to move the bees, with only half a crop harvested. A small crop was secured in 1887. In 1888 he secured 10,000 lbs. Another failure followed in 1889. In 1890 he secured 12,000 lbs.; in 1891, 10,000 lbs.; 1892 was poor. He began 1893 with 700 colonies, and increased to 1000, taking 38,000 lbs. of honey from sages. Moving to the bean-fields he secured 8500 lbs. more. His instructions not being followed, he lost two extractings that year. From the home apiary that season (1893) he secured only 14,000 lbs. His total extractings for 1893 were about 35 tons. These large figures show the general run of Mr. Mendleson's success as a bee-keeper, and they are among the very largest we have ever printed.

LYMAN C. ROOT.

Lyman C. Root was born in St Lawrence Co., N. Y., Dec. 19, 1840. The better part of his education was obtained in "brush college;" but before entering this he had two terms in the academy, two in St. Lawrence University, and a course in Eastman's Business College, where he graduated in 1865. The eight years following he was with Mr. Quinby, for the last five years his partner. It was his high privilege to be associated with him during what may be called the transition period of modern bee-keeping; during the time of the most rapid changes from box to frame hives; the time of the dissemination of the Italian bee, the introduction of the honey-extractor, the invention of the Quinby bee smoker, the adoption of the one-comb section, and the perfecting of the new Quinby frame and hive. The various experiments that ended in the adoption of comb foundation were then in progress, and Mr. Quinby could have had no young man with him more enthusiastic and more helpful than the energetic L. C. Root, who released him from business cares, and gave him the needed leisure for study and invention. These were golden days for Mr. Quinby, well improved; and for Mr. Root nothing less, as he recalls the results obtained. Their supply-

LYMAN C. ROOT.

business rapidly grew to large proportions, and it was common for them to buy from three to five hundred colonies in box hives in the spring, transfer them to the new hive, and sell them to their customers in the different States.

After the death of Mr. Quinby, Mr. Root took his supply-business. To all of this must be added his literary work as regular contributor to the *American Agriculturist* and the *Country Gentleman*, with frequent articles to all the bee-journals of the country; his presidency of the North American Bee-Society, and of the Northeastern Association, with his long and laborious exertions in establishing the latter, and finally his re-writing Mr. Quinby's book—a task on which he expended a greater amount of careful, conscientious work, and which caused him greater anxiety, than though it had been entirely his own. For this last work Mr. Root was peculiarly fitted by his long

residence with Mr. Quinby, and knowledge of his methods.

In keeping bees Mr. Root has preferred to raise extracted honey, and to keep about forty colonies in a yard. His crop was usually as much per yard as his neighbors, who kept twice the number in a place. The most of this success was due to skillful manipulations, improved honey-gatherers, and wise selection of locations; but after subtracting all these there probably remains something to be credited to moderate-sized yards. One fall he put into the cellar at the Hildreth yard forty stocks, took the same out in the spring without the loss of a single colony, and produced from them 9727 lbs. of extracted honey, 4103 lbs. of which was gathered in just seven days. Is better evidence needed that the author of the "New Bee-keeping" is a practical bee-keeper?

Mr. Root takes an active part in every good work in the community in which he lives, and he is ready to make any possible sacrifice in working to elevate humanity. He takes great interest in temperance work, and has been an active member of the Good Templars since 1865.

In 1869 he was married to Mr. Quinby's only daughter, and his home is one in which intelligence, refinement, and happiness reside. I never met any one who appreciates his home, family, and friends more than does Mr. Root. His wife has been a true helpmeet to him: and in the rewriting of Mr. Quinby's book she took a prominent part in the composition of the same—a service she had also rendered her father in his last revision. Mrs. Root has had entire charge of the education of their two daughters, the elder of whom has just passed from the home instruction into the high school, while the younger will take another year to graduate in the home course.—*P. H. Elwood, in Gleanings, June, 1888.*

EDWIN FRANCE.

Edwin France, of Platteville, Wis., is noted as a producer of extracted honey on a large scale. He was born in Herkimer Co., N. Y., Feb. 4, 1824. His father was a furnace-man, molding and melting iron; and, having a large family to support, had difficulty in making both ends meet. At the age of eight, young Edwin was sent to live with his mother's brother, returning home at 16. He then served an apprenticeship of four years at the furnace, when his father bought forty acres of timber, which they cleared up as a farm, working at the furnace winters. At the age of 24 his father died, leaving him the main stay of the family. He gave up the furnace, and worked part of the time making salt-barrels summers, and cutting sawlogs winters. About this time he got, and kept on his little place in the woods, a few hives of bees.

At the age of 32 he took the "Western fever," and settled on a 200-acre prairie farm in Humboldt County, Iowa, marrying and taking with him a wife, leaving his mother in care of her older brother, a single man, amply able to care for her. Here again he kept a few bees. He lived here six years, farming summers and trapping winters, when the breaking out of the war brought prices of farm products down to a ruinous point, and he went on a visit to Platteville, Wis., intending to return when times brightened. Desiring some employment, he answered an advertisement, "Agents wanted, to sell patent bee-hives," and was soon the owner of the patent for his county. He made the hives himself; and as at that time nearly every farmer kept bees, the business paid well, and he soon bought two more counties. In his trades he got some bees, his starting-point as a bee-keeper. These he increased until in 1871, when he went into winter quarters with 123 colonies, bringing out 25 in the spring, and 14 in the spring following. Enlarging his hives, and studying the wants of the bees, led to better success, reaching 500 colonies in the spring of 1888, kept in six apiaries. In 1886, from 395 colonies he took 42,485

EDWIN FRANCE.

pounds of honey, increasing to 507. In 1885 his 320 colonies averaged 113 pounds each, and his 410 colonies in 1887 averaged 12 pounds each. He owns eleven acres in the city limits of Platteville devoted to garden truck and berries.

Mr. France and his son do all the work, except during a few weeks in the busy season, when he hires eight assistants from 12 to 18 years old. The whole ten go to one of the different apiaries each day, making a sort of picnic, and returning at night. Mr. F. has not written much for the press, but all he has written bears the marks of ripe experience.

PHILIP HENRY ELWOOD.

Philip Henry Elwood is a good illustration of the healthfulness of bee-keeping as a vocation. At the age of 23 he was advised by his physi-

cians to abandon a college course and choose some outdoor occupation, and now P. H. Elwood, the bee-keeper, is known as a man who tips the scales at 225 lbs. Soon after leaving school he was offered a desirable position as teacher of natural

P. H. ELWOOD.

sciences in a high school in Michigan, but the offer was refused. In 1872, at the age of 25, he commenced bee-keeping as a partner of Capt. Hetherington. This partnership was profitably continued for five years, when he removed a distance of 10 miles to Starkville, Herkimer Co., N. Y., where he has since remained, to carry on the business of raising honey. He was happily married in 1879. Mr. E. is a conservative bee-keeper, little inclined to rush after new things simply because they are new, and is sometimes accused of being at fault in not placing sufficient confidence in the recommendations of others. He cares more to be sure that his plans and implements are such as experience proves the best, than to be constantly trying to invent something new. He uses the small Quinby hive, and, after giving a thorough trial to outdoor wintering he winters exclusively in cellars. The larger part of his comb honey is put up in two-pound glassed boxes, and it was his honey that took the first premium at the Paris World's Exposition, exhibited in the same packing-cases in which it was shipped from his apiary. He prefers Italian hybrids, and keeps about 1300 colonies.

Conservative in most things, he was the first man in his county to cast a Prohibition vote, and in 1887 was run for member of the Assembly. However earnest he may be in other things, he believes that the preparation for the life to come is of infinitely more importance than any thing else in this life.

CHARLES DADANT & SON.

Charles Dadant was born in a village of the province of Champagne (now department of Haute Marne), France, May 22d, 1817, and died July 16, 1902. When a young man he was a traveling agent for a dry-goods firm, and afterward became a wholesale dry-goods merchant himself, subsequently leaving this business to associate himself with his father-in-law in the management of a tannery. In 1863 he came to the United States, intending to make a business of grape-growing, with which business he had been familiar from childhood, as it was the leading business of his native place. He did not know a word of English at this time, but by the aid of a dictionary he became acquainted with it, so that, four years later, he could write articles for the papers, but he never learned to pronounce English correctly.

In 1864, a love for bees, which had shown itself in childhood, asserted itself anew, and he obtained two hives of bees from a friend. After trying movable-frame hives side by side with the old European "eke" horizontally divided hives, the latter were cast aside, and in 1868 he tried to get the French apiculturists to try the Langstroth system, but was rebuked by M. Hamet, the editor of a French bee-journal, who has never ceased trying to fight against the invading progress of movable frames, although other bee-magazines have started in France which have done the work he might so well have done. About this time Mr. D. tried to import bees from Italy. In 1873 he went in person to Italy, but was not entirely successful till 1874, when he succeeded in importing 250 queens. These importations were kept up for years. In 1871 he started an out-apiary, and steadily increased the number of his colonies from year to year. In 1874 he took into partnership his son Camille P. Dadant, then 23 years old, who had been raised in the business. Since 1876 they

CHARLES DADANT.

have kept five apiaries, of 60 to 120 colonies each. They have built up a large trade in extracted honey—the product of their bees in 1884 having been 36,000 lbs. Messrs Dadant & Son are among the largest, if not the largest, manufacturers of

CAMILLE P. DADANT.

comb foundation in the world. Commencing with 500 lbs. in 1878, they reached in 1884 the enormous amount of 59,000 lbs. Both father and son have written no little for the American press. Mr. C. Dadant was better known as a writer for European publications, and has been one of the main expounders of American methods in Europe; and the Langstroth-Quinby-Dadant hive, introduced by him into the Old World, is largely used under the name of the Dadant hive. He published a *Petit Cours d'Apiculture Pratique* in 1874, in France. To him was committed the task of preparing a revised edition of Langstroth's book, and this he has also translated for publication in the French language. The English edition contains 520 pages, and has been fully brought up to the times.

DR. C. C. MILLER

One among the very few who make bee-keeping their sole business is Dr. C. C. Miller, of Marengo, Ill. He was born June 10, 1831, at Ligonier, Pa. With a spirit of independence and a good deal of self-denial, sometimes bordering upon hardship, young Miller worked his way through school, graduating at Union College, Schenectady, N. Y., at the age of 22. Unlike many boys who go through college self-supported, running into debt at the end of their course, our young friend graduated with a surplus of some seventy odd dollars, over and above his current expenses at school; but, as we shall presently see, it was at the expense of an otherwise strong constitution. He did not know then, as he does now, the importance of observing the laws of health. Instead of taking rest he immediately took a course in medicine, graduating from the University of Michigan at the age of 25. After settling down to practice, poor health, he says, coupled with a nervous anxiety as to his fitness for the position, drove him from the field in a year. He then clerked, traveled, and taught. He had a natural talent for music, which by hard study he so developed that he is now one of the finest musicians in the country. If you will refer to the preface to Root's Curriculum for the Piano (a work, by the way, which is possessed or known in almost every household where music is appreciated), you will see that this same Dr. Miller rendered "much and important aid" to the author in his work. In this he wrote much of the fingering; and before the Curriculum was given to the printers for the last time, Mr. Root submitted the revised proofs to the doctor for final correction.

His musical compositions are simple and delightful, and you would be surprised to learn that one or two of the songs which are somewhat known were composed by Dr. Miller. Speaking of two songs composed by friend M., especially to be sung at a bee-keepers' convention, Dr. Geo. F. Root, than whom no one now living is better able to judge, said, "They are characteristic and good."

DR. C. C. MILLER.

Dr. Miller also spent about a year as music agent, helping to get up the first Cincinnati Musical Festival in 1873, under Theodore Thomas. A fine singer, he delights all who hear him. Upon hearing and knowing of his almost exceptional talents for music, we are unavoidably led to wonder why he should devote his attention solely

bee-keeping; and this wonder is increased when we learn that he had salaries offered by music-publishing houses which would dazzle the eyes of most of us. But he says he prefers God's pure air, good health and a good appetite, accompanied with a smaller income among the bees, to a larger salary indoors with attendant poor health.

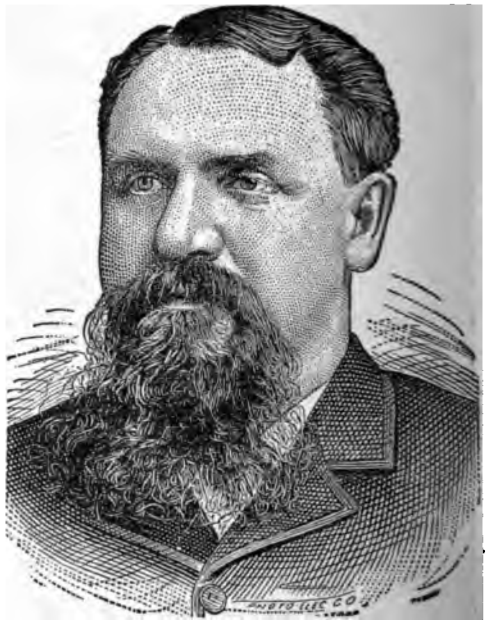
As has been the case with a good many others, the doctor's first acquaintance with bees was through his wife, who, in 1861, secured a runaway swarm in a sugar-barrel. A natural hobbyist, he at once became interested in bees. As he studied and worked with them he gradually grew into a bee-keeper, against the advice and wishes of his friends. In 1878 he made bee-keeping his sole business. He now keeps from 200 to 400 colonies, in four out-apiaries. All the colonies are run for comb honey, and his annual products run up into the tons. He is intensely practical, and an enthusiast on all that pertains to his chosen pursuit.

As a writer he is conversational, terse, and breezy. Not infrequently his style betrays here and there glimmerings of fun, which he seems, in consequence of his good nature, unable to suppress. His "Year Among the Bees," his large correspondence for the bee-journals, and his biographical sketches preceding this, as also his writings elsewhere in this work, are all characteristic of his style.

Of him as a man, a personal friend, and a Christian brother, it affords me great pleasure to speak. Physically he is rather under the medium height, thick set, and of an exceptionally pleasant face. To know him intimately, and to feel his intense friendship, is to know a near kinsman indeed. There are few more devoted Christians than Dr. C. C. Miller. He has always been active in Christian work, especially in all lines of Sunday-school work.—*E. R. Root.*

GILBERT M. DOOLITTLE.

Gilbert M. Doolittle was born April 14, 1846, in Onondaga Co., N. Y., not far from the home of his later years at Borodino, N. Y. During his childhood he often did duty by watching swarms from 10 to 3 o'clock, and at the age of eight was given a second swarm for the hiving. A thief, however, emptied the hive of its contents; and as foul brood prevailed in that region during several of the succeeding years it was not till the spring of 1869 he laid the foundation of his present apiary by purchasing two colonies of bees. Like many others he commenced with great enthusiasm, diligently studying all the books and papers obtainable, but, unlike many others, he has never allowed his enthusiasm to die out, and is today a diligent student of the ways of the busy bee. It is rare to find any one so familiar with what has been done and written relative to bee-keeping. As a business, Mr. D. has made bee-keeping a success, although he has never kept a large number of colonies, principally if not wholly because he prefers to keep no more than he can manage without outside help. In 1886 he wrote in the *American Bee Journal*, "From less than 50 colonies of bees (spring count) I have cleared over $1000 each year for the past 13 years, taken as an average. I have not hired 13 days' labor in that time in the apiary, nor had any apprentices or students to do the work for me, although I have had many applications from those who wished to spend a season with me. Besides my labor with the bees, I take care of my garden and a small farm (29 acres); have charge of my father's estate, run my own shop and steam-engine, sawing sections, hives, honey-crates, etc., for myself and my neighbors; write for seven different papers, and answer a host of correspondence." Mr. D. works for comb honey and also makes quite a business of rearing queens for sale. Although a prolific writer, his fund of information never seems exhausted, and he is uniformly practical and interesting. His writings give evidence of the close and careful thinker. In personal appearance Mr. D. is of commanding presence, being large and well-formed, of sandy complexion, and in manner he is a genial Christian gentleman.



G. M. DOOLITTLE.
From Scientific Bee-keeping.

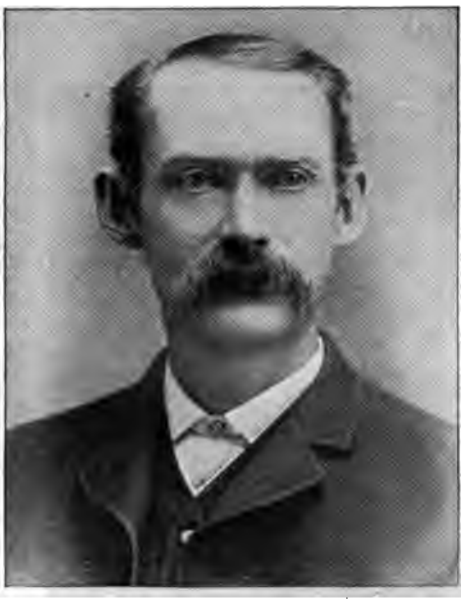
In 1889 he brought out his book, "Scientific Queen-rearing," a work that has a large sale, and is almost universally regarded as the best book on the subject extant. For particulars regarding his methods, see "Queen-rearing" in the body of this work.

JAMES HEDDON.

James Heddon was born Aug. 28, 1845, in the Genesee Valley, New York. Early in life he removed to the West; and for years Dowagiac, Mich., has been a name well known to bee-keepers, because it is the home of James Heddon. Endowed by nature with a mind of remarkable vigor he lacked the advantages of much training in schools, and possibly also its disadvantages. His entrance into the ranks of bee-keepers, about the year 1869, may probably be traced to the fact that he married Miss Hastings, the daughter of a bee-keeper, serving an apprenticeship with the father. Few

have shown such faith in bee-keeping, for Mr. H. was the first in the State, and one of the first in the country, to make a specialty of that pursuit, and few have shown that their faith was so well founded; for, commencing with nothing he credits his capital, amounting to thousands, entirely to the aid of the little busy bee. His apiaries have some years contained between 500 and 600 colonies. In 1879 he added the supply-business.

Mr. Heddon is slight and wiry in figure, below the medium size, of sandy complexion, and intensely nervous in temperament. This nervous tendency leaves its strong impress on his writings, and more especially on his speaking. To that, and to the state of health resulting from it, may perhaps be attributed a fierceness in controversy, especially in his earlier writings, that would hardly allow one, who had never seen him, to give him credit for the affability that he really possesses. As might be expected, both in writing and speaking, he is possessed of great vigor. He is a prolific writer, and, when not too much carried away by controversy, eminently practical. In 1885 he published "Success in Bee Culture," a practical work, giving his plans of bee management, as also a description of the Heddon hive invented by him —a hive having the brood-chamber divided into two sections, with the intention of making manipulation by hives rather than by frames. He is also editor and publisher of the Dowagiac *Times*.



JAMES HEDDON.

Among his inventions, aside from the Heddon hive, are the Heddon surplus case and the slat honey-board, so extensively used. He is the father of the "Pollen Theory." Mr. Heddon is by no means guided by what is merely popular, seeming rather to take a delight in the opposite, and for a time championed box hives after their general abandonment. He now prefers a carefully bred cross of Italians and blacks.

H. R. BOARDMAN.

H. R. Boardman was born April 2, 1834, in Swanzey, N. H., and at about one year of age he was taken to what was then the wilderness West, and during nearly all his life his present place of residence, East Townsend, Ohio, has been his home. The district school was his only college, unless we take into account the opportunities for develop-

H. R. BOARDMAN.

ment afforded by an acquaintance with the wild woods, abounding in deer, turkeys, and other wild game. Mr. Boardman says, "The wild woods have ever possessed a charm for me. The pages of Nature's great open book have furnished me much with which to make life pleasant; and it is this æsthetic taste, no doubt, that has led me to my present occupation of bee-keeping." Mr. B. has a cabinet of mounted specimens of birds, prepared by his own hands, in which he takes a pride next to that which he takes in his apiaries.

Mr. Boardman's training as a bee-keeper commenced at a very early age. His father was a bee-keeper of the old school, and a very successful one. By means of box hives and the brimstone-pit he secured honey for the family table, and also some to sell, nearly every season. Later on, boxes were put on top, the boxes sealed around with lime mortar or moist clay, to exclude the light entirely, in order to induce the bees to commence work in them. One year his father bought 25 colonies of bees early in the season, away from home; and as there was no one to watch them at swarming time, he tiered them up by putting an empty hive over each colony, there being a hole through which the bees could pass into the hive above. In the fall

the bees were brimstoned, and the honey hauled home, nearly a ton! Considerable *wild* honey was also obtained from the trees. The abundance of these wild bees before tame bees were abundant, suggested, Mr. B. thinks, that they were native.

Mr. B. is a careful observer, doing his own thinking, and adhering to plans which he has found successful. He produces comb honey, and keeps 400 or 500 colonies in four apiaries. He is *remarkably* successful in wintering. He aims to secure a moderate yield with moderate increase, and has thus carried on a profitable and increasing business.

J. E. CRANE.

The subject of this sketch was born May 15, 1840, on a farm in the town of Bridport, in Western Vermont.

J. E. CRANE.

At twenty-five Mr Crane commenced the study of medicine, but soon felt it necessary to give it up for the free open-air life of the farm. Having given up his last hope of an education he turned to farm life again, and at once bought one or two hives of bees, hoping, by the aid of them, to be able to pay for the necessary labor of carrying on a farm. His brother went into company with him. The first year proved a complete failure; but the next year they secured from six or seven hives as many hundred pounds of comb honey. From this time Mr. Crane's success with bees has been constant, varying with the seasons. He increased his stock until he had nearly 700 hives of his own. For the last few years he has usually wintered only about 500 colonies in five yards, as it is as many as he has strength to care for. He believes it safe to say that he has produced much more honey than any other person in New England. He has produced comb honey almost entirely, leaving to others the simpler method of extracting.

As his conveniences for wintering bees in cellar were not good, nor results satisfactory, he early began experimenting wintering out of doors, and was one of the first in the country to adopt winter packing. This system of wintering has been largely adopted in Vermont, and nearly all bees there are wintered on their summer stands.

Mr. Crane has been twice married, having no children by his first wife.

During the winter of 1898-99 he met, while in Washington, an old acquaintance who told him that it seemed very doubtful, in the neighborhood where they both lived in early life, whether he would ever be able to take care of himself as he was so frail and sickly. Thanks to the bees and the constant outdoor life, he is now, at over sixty, quite well, although not strong, and looking forward to many more years with his bees, in which he is much interested.

For many years he was superintendent of a Sunday-school in his native town, and has served in that capacity since residing in Middlebury. This is work he thoroughly enjoys. Mr. Crane was for many years deacon of the church of his native town. He has been for many years much interested in temperance work; prepared a large number of lantern slides, and, with their use, gave some temperance lectures, but was compelled to give them up for lack of strength. He is now on the executive committee of his county Anti-saloon League.—*W. P. Root, Medina, Ohio.*

A. E. MANUM.

Augustin E. Manum, whose picture is herewith presented, was born in Waitsfield, Vermont, March 18, 1839. When the war broke out he enlisted in Co. G, 14th Vermont regiment, as a nine-months' man. He served at the battle of Gettysburg, where his comrades in line on either side were killed; his own gun shattered, and he was hit four times.

A. E. MANUM.

In March, 1870, a friend desired to lend him "Quinby's Mysteries of Bee-keeping." Reading the

book, his enthusiasm upon the subject was kindled, and he immediately purchased four colonies of bees and began the study of apiculture. Having a natural aptitude for the business, and a love for the bees, he was successful from the first. His apiary so rapidly increased that, at the end of four years, when he had 165 colonies, he sold out his harness-business and began the pursuit as a specialist.

Since 1884 Mr. Manum has devoted all his energies to the production of comb honey, increasing his plant until his bees now number over 700 colonies in eight apiaries. He always winters his bees out of doors, packed in the "Bristol" chaff hive. For the eight years previous to 1887, his average loss in wintering for the entire time was only 3½ per cent. He uses exclusively a frame about 12¾x10 inches, outside measure, which he considers the best for practical purposes in his apiaries. His hive, the "Bristol," is almost entirely his own invention, being specially adapted to the perfect working of the system upon which his bees are managed. In 1885 his production was 44,000 pounds of comb honey, an average of 93½ pounds per colony, all made in twelve days, from basswood.

Mr. M. is of medium height, with dark complexion, hair, and eyes. A kind friend, an upright gentleman, and a thorough business man, he has attained an enviable position among the bee-keepers of Vermont, where he is so universally known. His extensive operations, his uniform success, and his practical writings have also given him a national reputation.—*J. H. Larrabee, in Gleanings, page* 301, *Vol. XVII.*

W. Z. HUTCHINSON.

W. Z. Hutchinson is one of the many, who, although born in the East, have spent in the West all of life that can be remembered. Born in Orleans Co., N. Y., Feb. 17, 1851, he was taken, four years later, with his father's family, to the dense forests of Genesee Co., Michigan, where his father literally hewed out a farm. W. Z. had the full benefit of pioneer backwoods life; and although hunting, trapping, etc., had a full share of his time, his natural bent was toward machinery. This passion for machinery was, as he advanced in his "teens," put to practical use by building a turning-lathe, and beginning the manufacture of spinning-wheels and reels. These he continued to make for several years, peddling them out in the surrounding country. At eighteen he began teaching school winters. While thus "boarding around," a copy of King's "Text-Book" fell in his way. It was to him a revelation. He learned that the owner had about fifty colonies of bees down cellar, which he was not long in asking to see, and for the first time he looked upon a movable-comb hive —the American. The next season, in swarming time, he visited this friend, and the charms of bee-keeping appeared greater than those of any other business. Although not really owning a bee till the lapse of many months, he became then and there in spirit a bee-keeper, reading all he could find on the subject, and visiting bee-keepers. The introduction of woolen-factories compelled him to abandon the spinning-wheel trade; and one afternoon in June, while peddling out his last lot, he made a sale to a farmer about 16 miles from home; and although it was only about four o'clock, he begged to be allowed to stay all night, urged thereto by the sight of a long row of brightly painted hives. This bee-keeper had an only daughter, and the reader can weave his own romance, upon being told that the father, Mr Clark Simpson, became the father-in-law of Mr. Hutchinson.

W. Z. HUTCHINSON

In 1877 he began bee-keeping with four colonies, and an excellent theoretical knowledge of the business. Mr. H. has never kept a very large number of colonies, but has made a comfortable living by the sale of comb honey. In 1887 he moved from Rogersville to Flint, Mich., where he established the *Bee-Keepers' Review*, which fills a place not previously occupied, and is edited with the ability that might be expected from one who has been so favorably known through his many articles published in the bee-journals.

In appearance, Mr. H. might more readily be taken for a professional man than for a farmer or bee-keeper. Tall, straight as an arrow, with side whiskers, and rather dark complexion, he presents a conspicuous figure at the gatherings of bee-keepers, where he is always in office, whether the gathering is local or national.

GEORGE W. YORK.

Geo. W. York is better known as the editor of a bee-journal than as a bee-keeper. To edit and publish each week a journal in so able a manner as that in which Mr. York edits and publishes the *American Bee Journal* leaves time for bee-keeping on only a very limited scale.

George Washington York was born Feb. 21, 1862,

at Mount Union, Stark Co., O., where his father, John B., was completing his studies at Mount Union College.

In 1882 he was graduated from the commercial department of Mount Union College, and continued there for a time as instructor in penmanship, mathematics, and book-keeping. A subsequent en-

GEORGE W. YORK.

gagement at the same school he had first taught led to acquaintance with T. G. Newman, editor and publisher of the *American Bee Journal*, and on April 1, 1884, Mr. York went to Chicago to work in any part of Mr. Newman's business or in that of his son (a supply-dealer) in which they might desire his services. That ranged from sweeping out the office to reading proof, including setting type, washing the windows, acting as shipping-clerk, etc. It was precisely the training to fit him for the position he has so well filled these later years. His remarkable memory soon made him as good as a cyclopedia to his employer, who could depend upon him for names, addresses or to find any item that had appeared in the journal. In an editorial in 1892, Mr. Newman said, "Step by step he advanced to positions of responsibility and confidence, until, during our late and long-continued indisposition, he has had the entire editorial management of this journal."

At this date, 1892, Mr. York bought out the journal, almost his sole capital being his experience, having enough to pay for a third and going in debt for the rest. Six years saw him clear of debt, and seven with a subscription list 40 per cent larger than when he took it.

A very pleasing manner, united with real executive ability, makes his office work move without friction, a strong bond uniting together his office force in unusual loyalty to the employer. His constant study is for some fresh improvement for his beloved journal. The clock-work regularity of its weekly appearance is something remarkable.

Since 1878 an active worker in the M. E. Church, he has been prominent in Sunday-school and League work, and his wife and he, both good singers, have rendered efficient service with their voices. He is an officer in the church at Ravenswood (a suburb of Chicago, where he has a delightful home), and since 1896 superintendent of its Sunday-school of 600 members. For two years in succession he was honored with the presidency of the North American Bee-keepers' Association, which office he has filled with the same characteristic faithfulness and energy that have marked his career as editor and publisher.

PROF. A. J. COOK.

Albert J. Cook was born August 30, 1842, at Owosso, Mich. Those who are intimately acquainted with the man will not be surprised to learn that his parents were thoroughly upright Christians. The daily reading of the Bible, with comments by the father, re-enforced by the constant example of a chaste, honest, and industrious daily life, left its impress for life on the character of the son.

PROF A. J COOK.

At the age of 15 he entered Michigan Agricultural College, where he graduated at 20, having been obliged during his course to suffer the sharp disappointment of suspending study a whole year on account of sickness, his health having been rather delicate during his earlier years. Upon his graduation he went, on account of poor health,

to California, where for three years he labored very successfully as a teacher. He then studied a portion of two years at Harvard University and Harvard Medical College with Agassiz, Hazen, and Dr. O. W. Holmes as teachers. In 1866 he was appointed instructor at Michigan Agricultural College, and in 1868 Professor of Entomology and Zoology in the same college.

He has done and is doing a work unique in character, for he instructs the students, not only about insects in general, but about bees in particular. Every student that graduates goes all over the theory of bees, studies the bee structurally from tip of tongue to tip of sting, and goes through with all the manipulations of the apiary —that is, if there is any honey to manipulate; handles the bees, clips queens, prepares and puts on sections, extracts, etc. Probably in no other institution in the country, if in the world, is this done.

Prof. Cook was an actual and influential member of the North American Bee-keepers' Association, of which he has been president; was one of the originators of the Michigan State Bee-keepers' Association, of which he was president for a number of years, and helped start the State Horticultural Society, being a member of its board for some years. He is widely known as a writer. His "Manual of the Apiary" has reached a sale of 19,000 copies, and "Injurious Insects of Michigan" 3000 copies. He is also the author of "Maple Sugar and the Sugar-bush," of which 5000 copies have been published. He has written much for bee-journals, as also for the general press. He is a clear, practical writer with a happy style.

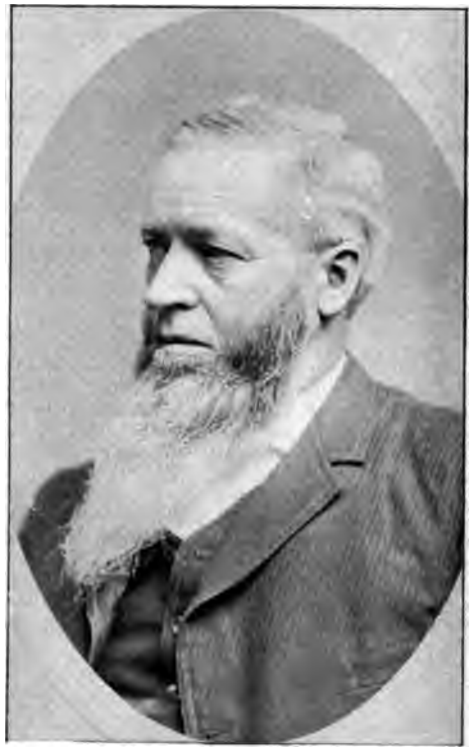
In the battle waged against insect-foes, he has rendered valuable service. Remedies which he first advised are now common, and he was probably the first to demonstrate the efficacy and safety of Paris green for codling moth.

Prof. Cook is of average height and weight, a charming conversationalist, and an intensely interesting lecturer. His very pleasant manner is only a fair index of a genial and loving spirit that, in an unusual degree, strives to put the best construction on the conduct and motives of every one, and throws a mantle of charity over their faults. His spirit of kindness extends to the brute creation, and on his farm, in which he is much interested, he has some fine-blooded stock; and in attempting to engage a hand to work upon the farm, the writer once heard him stipulate as essential that the employee must be kind to animals, and free from the use of liquor, tobacco, and profane language.

In December, 1893, Prof. Cook removed from Michigan, and went to Claremont, Cal., where he now fills the chair of Entomology in Pomona College.

DR. A. B. MASON.

Dr. A. B. Mason was born in the town of Wales, Erie Co., N. Y., Nov. 18, 1833. His father and maternal grandfather were soldiers in the war of 1812. Dr. M. was raised on a farm, and all six of his brothers are farmers. At 17 years of age he taught successfully a school in De Kalb Co., Ill., for $14.00 a month, and "boarded around." At the close of this school he attended several terms at Beloit (Wisconsin) college. He then commenced the study of medicine, attending lectures during the winters of 1857 and 1858 at the University of Michigan, at Ann Arbor. In 1862 he moved to Waterloo, Ia., and, the practice of medicine not being to his taste, he adopted dentistry as his life profession, having studied it in connection with medicine. He was president of the Northern Iowa Dental Association for two years.



DR. A. B. MASON.

In his 19th year he united with the church, and is an earnest Christian worker. For years he was an active, if not the most active member of the church to which he belonged, being at one time the superintendent of the Sabbath-school, church clerk, a trustee, and clerk of the board of trustees. He was a leader in Sabbath-school work at home and in adjoining counties. One year he was secretary of eight different organizations, four of them religious. Dr. Mason has always been an earnest temperance worker, neither he nor any of his children using tea, coffee, tobacco, or liquor in any form.

In 1869 a brother left in his care two colonies of bees till convenient to move them. Watching these aroused an interest in bees, and, as usual, the way to bee-keeping in full was not long. In 1873, frequent and severe attacks of rheumatism obliged him to give up the office practice of dentistry, and he has since made a specialty of bee-keeping, making it a source of revenue.

In 1874 he moved to Ohio, where he has always been prominent in apicultural matters. Through his efforts the Tri-State Fair Association at Toledo was induced to offer premiums for the dis-

play of the products of the apiary, and this display has increased in attractiveness each year since. He was appointed superintendent of the d partment the first year, and still holds the position. He was chosen superintendent of the Apiarian Department of the Ohio Centennial Exposition, held at Columbus, in 1888. In 1882 and '83 his apiary of 75 colonies suffered from foul brood, nearly every colony being infested in the latter year; but he cured it and has had no return of the disease. Dr. Mason is a poultry-fancier, and was for four years secretary of the Buckeye Union Poultry Association.

Large in size, and of fine form, Dr. Mason is always prominent at conventions, where he is still more conspicuous by his never-failing joviality and good nature. In 1887 he was made president of the North American Bee-keepers' Society. He was re-elected to that position for 1888-89. He was subsequently elected secretary of the organization and re-elected to the position for several successive terms.

MILES MORTON.

Mr. Miles Morton was distinguished, not because of his having owned a large number of colonies, nor for producing large crops of honey (although he was prominent for both), but because of the fact that he was a fine mechanic and an inventor as well.

He was born in Groton, N. Y., in 1836. He early commenced work in his father's carriage shop, and very soon became an expert in woodworking and blacksmithing.

He soon began the manufacture of bee-keepers' supplies, and supplied his friends and neighbors for miles around in a locality that probably has

MILES MORTON.

more bees and colonies to the square mile than any other one section in the United States. He was continually experimenting that he might improve upon the old methods and old supplies. Among other things he was one of the first to adopt a tall section, and among the very first to bring into use the cleated separator, or "fence," as we now call it.

When the writer called on Mr. Morton in 1897 he found his barn a veritable "curiosity-shop," for it seemed as if he had experimented with nearly every plan, method, and device known, and finally had settled down on the eight-frame Langstroth hive with a super that would take four-piece sections and slatted separators. It was at this time that he showed me the value of the fence; and when I came home and introduced it to the bee-keeping public through our journal, *Gleanings in Bee Culture,* it met with a ready reception, since which time the plain section and fence have grown rapidly into favor.

Mr. Morton freely gave the products of his genius, notwithstanding his experiments had cost him hundreds of dollars. Quiet in his manner, one would not at first measure up the man at his true value; but as one became more and more acquainted with him he realized that here was every inch a man, a true gentleman, and Christian friend.

Mr. Morton died Sept. 1, 1898. Relatives, friends, bee-keepers—in fact, the whole community for miles around—felt that they had suffered an irreparable loss. His quiet Christian character had left its deep impress on every one who knew him, and the whole bee-keeping world will one day recognize, if it does not now, his contribution to the more modern system of comb-honey production.—*E. R. Root.*

O. O. POPPLETON.

O. O. Poppleton was born near Green Springs, Seneca Co., O., June 8th, 1843. When four years old his parents removed to Napoleon, Henry Co., O., where, two years later, his father died, leaving his mother a widow with two sons, in straitened circumstances. Two years later his mother married Mr. Joseph George, of Clyde, O., and settled in Sandusky Co. After living there a few years the great inducements of the West influenced his stepfather to move to Northern Iowa, where they settled in Chickasaw Co., when Mr. Poppleton was 12 years of age. This was his home until 1887, when he removed to Florida on account of his health.

In October, 1861, he enlisted as a private in the 7th Iowa Infantry, and re-enlisted as a veteran in 1863. In February, 1864, he was promoted to a lieutenancy in the 111th U. S. C. Inf., and a few months later he was made regimental adjutant. It was while performing the duties of this office, and also at the same time those of post-adjutant at Murfreesboro, Tenn., that overwork resulted in the eye-trouble that has so seriously affected his health ever since, and which compelled the refusal of an excellent offer of employment at the time of mustering out. He served his country faithfully for five years; and though he received no scar upon his body, yet the smell of smoke was strong upon his garments. He was in several hard-fought battles, and taken prisoner once, but was held only a few weeks, when he was released or exchanged.

On account of having such poor health he made no effort to do a large business, but confined himself to a simple apiary varying from 75 to 150 colonies, spring count, and to the almost exclusive production of extracted honey. For the last ten years

that he lived in Iowa, his annual crop of honey averaged 110 lbs. per colony. His half-brother, Mr. F. W. George, has had charge of his apiary since his removal to Florida.

Some fourteen or fifteen years ago he discovered the value of chaff as a winter protection for bees, without knowing that any one else, notably Mr. J. H. Townley, of Michigan, had previously made the

O. O. POPPLETON.

same discovery. He also invented the solar wax-extractor about the same time. He was vice-president for several years of the N. A. B. K. A.; president of the Iowa B. K. S., and honorary member of the Michigan State Bee-keepers' Society.

Mr. Poppleton is of spare figure, hardly up to medium size. His very pleasant manner is only a fair index of a genial and loving spirit that, in an unusual degree, strives to put the best construction on the conduct and motives of every one.—*Condensed from Gleanings in Bee Culture for May* 1, 1889, *from a sketch by Mrs. M. George.*

HON. R. L. TAYLOR

R. L. Taylor, ex-president of the National Bee-keepers' Association, was born on a farm at Almont, Lapeer Co., Mich., Nov. 3, 1839. He was the son of Scotch parents who were pioneers in that new, heavily timbered part of Michigan. We hardly need say more to prove that our friend was early taught to be religious, truthful, honest, and industrious; for how loyal are almost all the Scotch to all these grand principles, which are the very basis of true manhood! Pres. Taylor was one of fourteen children. Like most farmer boys, he worked on the farm summers, and went to common district school in winter. At the age of nineteen he lost his father, who was carried off by an accident, when the severe and arduous duties of a large farm devolved on our friend. But he had learned to labor, and was equal to the emergency. But our friend aspired to a college education. He taught winters, and *prepared himself* for the Classical Department of the Michigan University, which he entered in 1862.

In 1865 Mr. Taylor left college. He entered mercantile life, which he followed at Almont very successfully for three years. But mere business was not wholly to Mr. Taylor's taste, and so he spent his spare time in the study of law. He was admitted to the bar in 1869. In 1872 he was elected Register of Deeds by the largest majority ever received by any county officer of his county. He then moved to Lapeer, where he has resided ever since. Two years later he was re-elected. In 1877 he resumed the practice of law, and was elected Prosecuting Attorney the following year.

At that time, fortunately for apiculture, two colonies of bees fell into Mr. Taylor's possession. They increased rapidly, and his interest kept pace, owing, doubtless, to the success which marked his labors from the first. Thus he declined a re-nomination as Prosecuting Attorney, and very soon gave up the practice of law, that he might devote his entire time to his bees. Thus here as everywhere Mr. Taylor is consistent. He preaches exclusive apiculture for the apiarist, and practices what he preaches. He is, perhaps, the largest bee-keeper in the State of Michigan.

HON. R. L. TAYLOR.

As an apiarist he stands among the first. His cautious, scientific, thoroughly informed mind grapples even with foul brood, and the fell disease is worsted in the struggle. He told me once, as I visited his apiary, that he rather enjoyed the malady, as it was interesting to watch and str

How few are cautious enough to hold this dire scourge at arm's length, even though it be right in the apiary!

Mr. Taylor's style as a speaker and writer is quite earnest but very convincing. He is candid, very cautious, and rather conservative; so those who know him place great weight upon his opinion or judgment. Slow to draw conclusions, his conclusions rarely need reconsideration. In our literature, in our conventions, and, best of all, in his home city, he is a power. His presence is felt to be of signal advantage.

That Mr. Taylor's neighbors appreciate his worth is evinced by the fact that he was elected to our State Senate in 1888, where he was an able member.—*Condensed from Gleanings in Bee Culture for Nov. 1, 1890, from a sketch written by Prof. A. J. Cook.*

EUGENE SECOR.

Eugene Secor was born in Putnam Co., N. Y., in 1841, and it was his good fortune to be kept there on a farm until he attained his majority. In 1862 he went to Iowa, entering Cornell College at Mount Vernon. A brother who was county treasurer and recorder, as well as postmaster, enlisted to hold up his country's flag, and Eugene aband-

HON. EUGENE SECOR.

oned his college course to take charge of his brother's business, thus occupying two years. Had his health been more robust, he probably would have borne his brother company in the army.

Asked what his business is, aside from bee-keeping, Mr. Secor replies, "When the bees are not swarming, and no public duty calls me, I 'recreate' by running a real-estate and abstract office in the daytime, and writing for the papers at night."

In spite of his special interest in apiculture he has a leading hand in agricultural matters, having organized the agricultural society of his county (Winnebago), of which society he was president for two years, and in 1888 he was elected by the State legislature one of the board of trustees of the State Agricultural College, to serve a term of six years.

The State Horticultural Society showed its appreciation of his services by re-electing him as president thereof and giving him charge of one of its experiment stations. The State Bee-keepers' Society elected him president in 1891 and 1892.

In 1896 Mr. Eugene Secor was elected to the position of General Manager of the United States Bee-keepers' Union. When the National and the United States Bee-keepers' unions were amalgamated into what is now known as the National Bee-keepers' Association, Mr. Secor, by the act of amalgamation, was made General Manager of the new organization. Ever since, he has been unanimously re-elected to the position. The office has required tact, executive ability, and general business qualifications. In all of these points Mr. Secor has filled the bill. One of the strong characteristics of his make-up is geniality. There is no more popular bee-keeper in the ranks of all beedom than "Genial Gene." His popularity, coupled with his other qualifications, has placed him and maintained him in the position he has held with such credit.

Most of the readers of these pages are more or less familiar with the poetic writings of Mr. Secor, and he has been especially happy in his dialect songs. Take that one in which the good-natured German has been hearing the big stories of what bees will do with little or no care. He gets a colony of bees and then sings, care-free,—

> Oh! I ish von of dose happy bee-mans,
> I don't got to vork any more,
> I loafs all day on der apple-tree shade,
> Or smokes mine pipe on der door.

After all, I like best the poems which show his tender side. I think the right kind of heart never grows old, and Eugene Secor's heart seems to be of that sort. The poem, "A love-letter," shows finely this tender side, with a quaint touch of the humorous. No proper idea can be had from any short quotation; but after a description of his anxiety to meet again his loved one, that involuntarily pictures to your mind the ardent young lover, he winds up,—

> For love is in the *present* tense, no *future* doubts can chill;
> Besides, the one who longs for me, 'twixt anxious hopes and fears,
> Has been my wife and true love, lo! *these five and twenty years.*

While you smile at the neat little trick that has been played upon you, on discovering that it is a grandfather, and not a youth, who is talking, the whole effect is such that tears are near the surface.

Spare in form, somewhat above medium height, iron-gray hair and beard, Mr. Secor's whole appearance impresses you as belonging to a man of force; but in another respect the face belies the man, for it gives the impression of inflexible sternness, with no hint of the genial, kindly nature that lies back of it. Modest and quiet in demeanor, you might be with him for some time without finding out what he was.

JOHN H. MARTIN.

John H. Martin, better known, perhaps, as "Rambler," was born in the town of Hartford, N. Y., Dec. 30, 1839.

In 1868 he married Miss Libbie C. Edwards, who died in 1881, leaving no children. She was an estimable lady, and her death was a great loss to all.

For many years Mr. Martin followed agricultural pursuits on his father's farm; but owing to a rather frail constitution, and the death of his wife,

JOHN H. MARTIN.

followed, in 1883, by the death of both his parents, he gave up the farm entirely; and bee culture, which had formerly been a side issue was given all his time and attention.

As early as 1874 we find him with 55 colonies of bees, and a contributor to *Gleanings in Bee Culture*. Since that time his apicultural career has been plainly indexed by his contributions to that journal. While he resided in New York it was his method to keep from 200 to 300 colonies, running them for extracted honey, and doing all the work himself, except during the extracting season. One season his crop was 16,000 lbs. of honey, and his average for twelve or fifteen years was about 7000 lbs. of extracted honey per year. After the advent of the Heddon hive he adopted it and its methods, and the chaff hives and outdoor wintering were discarded.

In person Mr. Martin is quite tall and slender—there is not an ounce of spare flesh about him. In manner he is very modest and quiet, yet continually, through his eyes and in his words, one sees the humor of the man. He has great love for the quaint and humorous side of humanity, yet his humor never offends by its coarseness nor galls by its acidity. The series of articles written during the last few years, under the *nom de plume* of "Rambler," in *Gleanings in Bee Culture*, have made him well known to bee-keepers generally. His method of combining the entertaining and the instructive in a manner to make it read by all is very characteristic.

Mr. Martin's first article under his now favorite *nom de plume* was published in *Gleanings* for June 1, 1888. His first rambles covered the territory of Eastern New York, but they gradually enlarged till they took in the bordering States. But John was a rover, and could not be held down, and the circle of his wanderings kept on enlarging until he reached the land of the setting sun. Since the summer of 1891 his rambles have been confined particularly to California, Washington, and Oregon, and at the present time he is sojourning in Cuba, from which he is sending out an interesting series of articles. Assisted by pencil and camera he has made his travels among bee-keepers peculiarly graphic. Everywhere he went he was sure to be welcomed, and sometimes was recognized "on sight" by bee-keepers, even though they had never seen him. His long lank appearance, his striped pants, his characteristic long-tailed coat, his ever present umbrella and camera, were exhibited in a series of articles in hundreds of different poses. These, and his quaint way of writing, made him one of the most popular writers in bee culture. Indeed, he might almost be styled the Mark Twain of beedom.

Mr. Martin is a true Christian—very zealous in Christian work, and was a leading member and deacon of the Congregational Church of his town. He long served as superintendent of the Sunday-school; and in all matters pertaining to the spiritual and temporal welfare of society his influence is felt, and it is always on the side of right.—*Condensed from Gleanings in Bee Culture for March* 15, 1891, *from a sketch written by John H. Larrabee.*

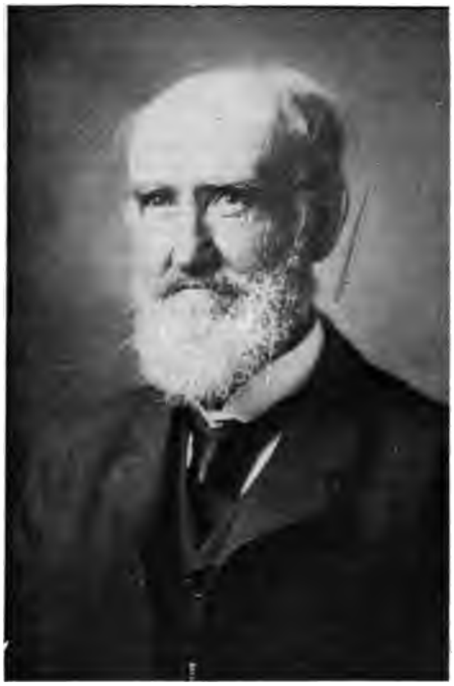
FRANCIS DANZENBAKER.

Francis Danzenbaker was born January 8, 1837, near Bridgeton, N. J. His interest in bees began at an early age. Being of an inventive turn of mind, he set to work experimenting with various improved devices; but it was not until he had been a bee-keeper for more than thirty years that he came prominently before the bee-keeping world, and that was in the summer of 1888. At this time he called the attention of the A. I. Root Co. to the value of the dovetailed, or, more properly speaking, lock corner, in hives—a feature that the company subsequently adopted, since which time it is used universally by all the manufacturers of bee-keepers' supplies. While it was conceded at that time that this joint would be satisfactory for packing-boxes, it was feared it would hardly be suitable to stand the weather. But experience during all these years has not only shown that it does stand, but it makes the strongest possible joint that can be devised outside of the true dovetail, a corner which would be impractical by reason of the expense of making.

And so Mr. Danzenbaker became prominent, not because he was an extensive bee-keeper, or produced large crops of honey, but because of the fact

that he introduced a number of valuable improvements in hives outside of the one already mentioned—the lock corner.

A believer in thinner combs, he at first advocated sections 4¼ square and 1⅝ inches thick to those 4¼ square and 1⅞ thick; but after having visited Capt. J. E. Hetherington, he became convinced that a box taller than broad was not only more artistic, and more in keeping with objects



FRANCIS DANZENBAKER.

around us, but economized space on the hive, so that more sections could be used per super. These he subsequently adopted for his hive.

Later on he introduced his shallow-brood-chamber hive, and afterward discarded this for what he now calls the Danzenbaker, making use of closed-end frames, plain sections, and slatted separators or fences. This hive is fully described under "Hives," to which the reader is referred.

Mr. Danzenbaker is a firm believer in a 4x5 section, and has proven to his own satisfaction, and that of his friends and followers, that it is a better seller than the regular 4¼, looks handsomer, and is less liable to break during shipment. See "Comb Honey."

He has traveled extensively over the country, visited many bee-keepers of note, with the view of bringing his hive to still greater perfection if possible. He has attended many conventions, is prominent in the discussions, and is ever the persistent advocate of closed-end frames, shallower hives, and taller sections. He is a user of neither tea nor coffee, liquor nor tobacco. Although 65 years old, when the faculties of most begin to fail, our friend is full of vigor and enthusiasm.—*E. R. Root.*

R. WILKIN.

R. Wilkin, whose death occurred in 1901, was one of the pioneer bee-keepers on the Pacific coast, going to California in 1875 with a carload of bees, and subsequently settling in the Sespe Valley.

His first experience with them was in helping to prepare a shipment of bees for Mr. Harbison, who was then about to leave Pennsylvania (where he was then residing) for California. This was some time in the early '50's; and the result of this venture, and how Harbison subsequently came to be the great bee-king of California, owning and operating at one time some 6000 colonies, are matters of history.

Mr. Wilkin's home was originally at Cadiz, Ohio. From this point he attained considerable celebrity as a bee-master; and so many were the questions that were plied him that he finally, to answer all, wrote a book of 100 pages, entitled "Hand-book on Bee Culture," which at the time, 1871, had a considerable sale.

Just what induced him to go to California is not stated. Possibly the success of Harbison, who had preceded him, had much to do with it; but after he had gone to the coast in 1875, with his family and a carload of bees, and had produced those enormous yields of sage honey in the now celebrated Sespe Apiary, his celebrity, which

R. WILKIN.

had hitherto been only local, was made worldwide. Here he produced honey by the carload, and sold in the London markets for a number of years.

His largest yield was in 1884, when he produced from his Sespe Apiary 60,000 lbs. of honey. The largest number of colonies he had in this yard at one time was 700. Such a number managed

profitably, in one apiary, seems. to an Eastern bee-keeper, almost incredible. But to one who has just come from the location, as I have, with its great mountains on every side, and the orange-groves in the valley, the number does not seem so impossible of belief after all. Indeed, to see is to believe.

In later years the Sespe Apiary has been occupied by his son-in-law, J. F. McIntyre; and during all the years this location has supported on an average 500 colonies.

Mr. Wilkin was twice elected President of the California State Bee-keepers' Association, and in all the doings of that organization was a prominent and conspicuous figure. There is many a present-day bee-keeper in the State who will remember the kindly services performed for them by our departed friend; and although he is gone he will not be forgotten.

W. F. MARKS.

W. F. Marks, of Chapinville, N. Y., while not an extensive bee-keeper in the sense that he owns a great number of colonies, yet he is one of the prime moving spirits both in bee-keeping and fruit-growing in his State. He is president of the New York State Association of Bee-keepers' Societies, and also Director of the National Bee-keepers' Association, and secretary, I think, of his county organization. Besides these he is an active member of various horticultural societies.

Mr. Marks is a born fighter; and while he is not disagreeable or antagonistic, yet when the interests of bee-keepers are at stake we find him at the forefront ready to do battle with the opposing forces.

Soon after the value of spraying fruit-trees was made known, it was discovered that bees were dying by the thousand during the spraying season, because the poisonous mixtures were adminstered during blooming time. But, soon ofter, it was discovered that just as good results could be secured by spraying before and after the trees were in bloom, thus saving the bees; and some even went so far as to say that *better* results could be thus secured. Realizing this fact, Mr. Marks was largely instrumental in getting through the New York Legislature a bill making it a misdemeanor to spray fruit-trees during the time they are in bloom. Although there was plenty of opposition, he and his friends saw to it that the measure was enacted into law. There have been attempts made since then to have it repealed; but President Marks was not asleep. Armed with statistics and facts from experiment stations and private persons, he soon satisfied the committee of the house that such repeal was unnecessary.

When foul brood began to develop in New York, Mr. Marks was at the front again in helping to secure legislation by which this dread disease, or any of a like nature, could be held in control. The wisdom of such legislation was soon made apparent when black brood broke out in all its virulence in the eastern part of New York. Again we find the "fighter" before the Commissioner of Agriculture of that State, urging the appointment of one or more special foul-brood inspectors. Through his own personal influence, and that of some other bee-keepers whose aid he had secured, four inspectors were appointed, with the result that in two years' time the disease was rapidly brought under control, and is not now feared as it once was.

President Marks has done more. perhaps, than any other man in his State in bringing about an organization of bee-keepers. As a result of his efforts there are now several flourishing county organizations, all affiliated with the State society of which he is President, and all of them are recognized by the great Empire State, and receiving aid in the way of speakers from a distance. He is also chairman of the Board of Directors of the National Bee-keepers' Association, a position that carries with it a large responsibility, as it involves in a peculiar way the interests of bee-keepers for the whole United States.

W. F. MARKS.

In everything that pertains to the general welfare of the bee-keeping industry we always find Mr. Marks interested, and yet he never, as he might, seeks office for himself. On numerous occasions he has spared neither his time nor his money. The only regret is that there are not more such unselfish bee-keepers like him, who are willing to do and to work for others.—*E. R. Root.*

EMERSON T. ABBOTT.

Rev. E. T. Abbott was born in Brown Co., Ohio, in March, 1847. As a young man he was an enthusiastic worker in the church and in the cause of temperance. His interest in these causes was so great that he finally entered the ministry. As a preacher of the gospel, and as a temperance worker, he was active, aggressive, and fearless.

and, with all his other qualities, a real orator. So active was he in his fight against the liquor business that on one occasion he was attacked by a druggist, and knocked down three times in the street; but this, so far from intimidating him or dampening his ardor, only fired him up the more.

He continued preaching until ill health and a failure of voice compelled him to go into something else, and this, fortunately for bee culture, was bee-keeping itself. He and some friends bought 200

EMERSON T. ABBOTT.

colonies of bees, and in two years more he bought out his partners, and went into bee-keeping in real earnest. He has now a large and flourishing bee-keepers' supply business at St. Joseph, Mo.

Mr. Abbott has been an active worker in the National Bee-keepers' Association. Once President of it, and chairman of the Board of Directors, he is still an active worker in the association. He has been sent three times as a delegate by the association to the National Pure-food Congress at Washington. On each occasion he received prominent recognition on the floor; was made chairman of the committee on organization, and Vice-President for Missouri. Later on he was made a member of the committee on legislation.

Besides bees, Mr. Abbott has taken an active interest in other rural industries, prominent among which is poultry. So successful was he in each department of work that he was finally appointed by the State of Missouri one of the lecturers at farmers' institutes; and although the writer has never heard him, yet I have been told that his talks on chickens bring down the house wherever he goes.

He is a practical and forceful speaker, and at every convention of bee-keepers which he attends he gains the closest attention, often calling forth round after round of applause.—*E. R. Root.*

WILLIAM McEVOY.

The subject of this sketch was born in Ontario, Canada, in 1844. At an early age (his father having died) he was thrown on his own resources; but this only served to make him, like other self-made men, a man of strong personality—one who could appear before legislative bodies, ask for what he wanted, and get it. It was largely through his influence that the foul-brood bill, and, later, the one against spraying, were made into law. But he is known to the bee-keeping world particularly from the fact that he is the official foul-brood inspector for Canada, and the originator of a special method of cure bearing his name. He has been very successful in his treatment, and has probably had a more extended experience with that dread disease, and cured more cases, than any other man in the world. So successful has been his work that he has been retained in his position term after term. While foul brood was rampant throughout Ontario

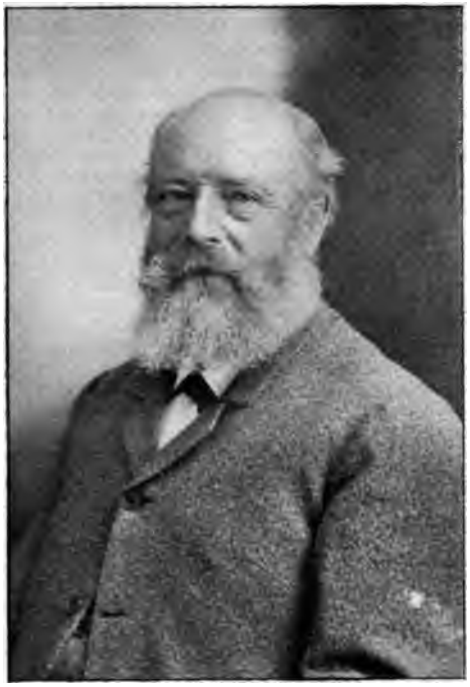
WILLIAM M'EVOY.

some years ago, Mr. McEvoy, by his painstaking efforts, together with his skill and tact with the bee-keepers having the disease, soon had it well under control.

He is prominent at conventions; and from his extended acquaintance, through his official capacity as inspector, is able to be of material aid to the bee-keepers of Canada.

J. B. HALL.

Mr. Hall was born in 1833 in Norfolk, England, but for the greater portion of his life he has been a resident of Woodstock, Canada. At that time he took up bee-keeping, first in a small way, and then gradually enlarged his business till he had as many as 500 colonies at a time, and as much as 25,000 lbs. of honey in a year—11,000 lbs. of which was comb.



J. B. HALL.

He is intensely practical, and one of the leading bee-keepers of Canada. While he never writes for the bee journals he is the soul and wit of any meeting of bee-keepers. An Ontario convention without J. B. Hall, with his good-natured enthusiasm, his sparkle, his wit, and his practical sense and advice, would be like the play of Hamlet with Hamlet left out. I have understood that Mr. Hall had felt that, owing to advancing years and a pressure of work, he could not afford to attend the conventions as before; but when it was learned he might not be present at one of the late meetings, a telegram was sent him guaranteeing his expenses, and begging him to come, which he did. The writer was present at that meeting, and after hearing our friend bubble over every now and then with practical, helpful suggestions, I did not wonder the convention felt that it could not afford not to have him present.

Mr. Hall was, I believe, the first to introduce what is known as the non-burr-comb thick-top-bar frame. He had discovered, before any of the rest of us, that a top-bar thick and wide, and properly spaced, would practically cure the burr and brace comb evil. He said but little about it, but continued to use it. Finally one supply manufacturer was induced to put on the market the Hall top-bar; and now it is made and sold by all manufacturers and is used almost universally throughout progressive beedom.—*E. R. Root.*

W. L. PORTER.

Mr. Porter is what may be called a specialist bee-keeper in the strictest sense—that is to say, his sole means of livèlihood is derived from bees. He has had as many as 700 colonies, but I believe he is now operating only 500, located in five or six different apiaries. He produces both comb and extracted—about an equal amount of each. In extracting, his daughter Mary, the oldest, runs the extractor, while her father and brother bring in the combs and do the uncapping. The younger daughter helps her mother, and occasionally both assist in the yard when the bees are especially crowding.

Mr. Porter has had a varied experience in bee-keeping. Born in West Virginia in 1850, he migrated with his parents northward to Michigan in 1864. His parents assumed the life of pioneers, clearing off the forests. Young Porter, with the rest of the boys, was detained from school to help the father, and the consequence was their early school advantages were limited.

W. L. PORTER.

In a short time afterward we find him at the Michigan Agricultural College, under Prof. Cook, as a student. His general aptitude for the bee business resulted in his being placed in charge of the apiary of the Agricultural College. He used well his opportunities, and finally became the pos-

sessor of some bees of his own. He suffered many reverses, but made the bees of some assistance to him financially in helping him through college. Ill health and a lack of funds finally compelled him to give up his course before he had completed it.

He subsequently drifted to Wisconsin, and formed a partnership with Miss Allyn—a partnership which he says was "very happy and successful." He very soon engaged in bee-keeping again, meeting with his usual success. But again ill health caused him and his wife to move to the land of gold, sunshine, and alfalfa honey in 1881, and here he has cast his lot and his fortune; and if I may judge from general appearances he has secured a fair share of the sunshine, of the alfalfa honey, and the gold which it brings.

E. R. Root.

A. I. ROOT.

Up till the edition of this work had reached the 75th thousand, there had been no biographical sketch in it of A. I. Root. Now that the authorship of the present work has passed largely out of his hands, it seems appropriate in the book which he named, and which he originally wrote, that at least a brief sketch should appear.

A. I. Root was born in a log house, in December, 1839, about two miles north of the present manufacturing plant of The A. I. Root Co. He was a frail child, and his parents had little hopes of raising him to manhood, although some of the neighbors said his devoted mother would *not let him die*. As he grew older his taste for gardening and mechanics became apparent. Among his early hobbies were windmills, clocks, poultry, electricity, and chemistry—anything and everything in the mechanical line that would interest a boy who intensely loved machinery. Later on we find him experimenting in electricity and chemistry; and at 18 he is out on a lecturing-tour with a fully equipped apparatus of *his own construction*.

We next find Mr. Root learning the jeweler's trade, and it was not long before he decided to go into business for himself. He accordingly went to an old gentleman who loaned money, and asked him if he would let him have a certain amount of money for a limited time. This friend agreed to lend him the amount, but he urgently advised him to wait a little and earn the money by working for wages. This practical piece of advice, coming as it did at the very beginning of his career, was indeed a God-send, and, unlike most boys, he decided to accept it. Imbued with a love for his work, and having indomitable push, he soon *earned* enough to make a start in business, without borrowing a dollar. The business prospered till A. I. Root & Co. were the largest manufacturers of *real* coin-silver jewelry in the country. From $200 to $500 worth of coin was made weekly into rings and chains, and the firm employed something like 15 or 20 men and women.

It was about this time, or in 1865, that a swarm of bees passed over his shop; but as this incident is given so fully in the introduction I omit it here. Not long after he became an A B C scholar himself in bees, he began to write for the *American Bee Journal* under the *nom de plume* of "Novice." In these papers he recounted a few of his successes and many of his failures with bees. His frank confession of his mistakes, his style of writing, so simple, clear, and clean-cut, brought him into prominence at once. So many inquiries came in that he was finally induced to start a bee-journal, entitled *Gleanings in Bee Culture*. Of this, how his business grew to such a size that the manufacturing plant alone covered five acres, and employed from 100 to 200 men—all this and more is told in the introduction by the writer.

As an inventor Mr. Root has occupied quite a unique field. He was the first to introduce the one-pound-section honey-box, of which something like 50,000,000 are now made annually.* He made the first practical all-metal honey-extractor. This he very modestly styled the "Novice," a machine of which thousands have been made and are still made. Among his other inventions may be named the Simplicity hive, the Novice honey-knife, several reversible frames, and the metal-cornered frame. The last named was the only invention he ever patented, and this he subsequently gave to the world long before the patent expired.

In the line of horticultural tools he invented a number of useful little devices which he freely gave to the public. But the two inventions which he considers of the most value is one for storing up heat, like storing electricity in a storage battery, and another for disposing of sewage in rural districts. The first named is a system of storing up the heat from exhaust steam in Mother Earth, in such a way that greenhouses and dwelling-houses can be heated, even after the engine has stopped at night, and for several days after. The other invention relates to a method of disposing of the sewage from indoor water-closets so that "Mother Earth," as he calls it, will take it automatically and convert it into plant life without the least danger to health or life, and that, too, for a period of years without attention from any one.

Some of the secrets of his success in business may be briefly summed up by saying that it was always his constant aim to send goods by return train, and to answer letters by return mail, although, of course, as the business continued to grow this became less and less practicable. He believed most emphatically in mixing business and religion—in conducting business on Christian principles; or, to adopt a modern phrase, doing business "as Jesus would do it." As might be expected, such a policy drew an immense clientage, for people far and wide believed in him. But how few, comparatively, in this busy world, go beyond the practice that honesty is the best policy! While A. I. Root believed in this good rule he did not think it went far enough, and, accordingly, tried to adopt and live the Golden Rule.

The severe strain of long hours of work, together with constantly failing health, compelled Mr. Root to throw some of the responsibilities of the increasing business on his sons and sons-in-law. This was between 1886 and 1890. At no definite time could it be said that there was a formal transfer of the management of the supply business and the management of the bee department of *Gleanings* to his children; but as time went on they gradually assumed the control, leaving him free to engage in gardening and other rural pursuits, and for the last ten years he has given almost no attention to bees, devoting nearly all his time to

*He did not invent a section box for holding honey, but only a box 4¼x4¼, or just the right size to put 8 into a Langstroth frame.

travel and to lighter rural industries. He has written much on horticultural and agricultural subjects; indeed, it is probable that he has done more writing on these subjects than he ever did on bees.

For the last twenty-five years he has been writing a series of lay sermons, touching particularly on the subject of mixing business and religion, work and wages, and, in general, the great problem of capital and labor. As an employer of labor he had here a large field for observation, and well has he made use of it. Perhaps no series of articles he ever wrote has elicited a more sympathetic response from his friends all over this wide world than these same talks; and through these he has been the means of bringing many a one into the fold of Christ.

It has been a rather difficult matter to get a picture that was in any way satisfactory to the members of his family. Finally the writer, one day, with a kodak, took a "time view" of him in his favorite place of resort, the greenhouse, among his "posies," where he spends hours of his happiest moments. This view shows him just as he appears around home in his everyday work clothes. Ill health, or a sort of malaria that has been hanging about him for years, has forced him, during winter, to wear a fur cap and to keep his overcoat constantly on, indoors and outdoors, with the collar turned up.

Mr. Root, ever since his conversion, in 1875, has been a most active working Christian. No matter what the condition of his health, he is a regular attendant at church and prayer-meeting. He takes great interest in all lines of missionary work, and especially in the subject of temperance. He annually gives considerable sums of money to support the cause of missions, and to the Ohio Anti-saloon League; and now that the heavier responsibilities of the business have been lifted from his shoulders he is giving more and more of his time and attention to sociological problems.—*E. R. Root.*

Before the foregoing was given to the printers, my son Ernest asked me to take time to read it over, and there is just one thing I wish to add. Since the "boys" have kindly relieved me from business, and permitted me to take wheelrides to visit successful gardeners, fruit-growers, and bee-keepers, I have enjoyed my vacation fully as much as I ever enjoyed any work or play in my boyhood days. It has been suggested by some that, as we grow older, we lose interest in things around us. It has not been so in my case. In fact, I have thanked God again and again for the liberty that I now enjoy (in this the 62d year of my age), of being able to take up and follow out, without interruption from business, any wonderful line of industry that I may come across or hear about in this busy world of ours. Many thanks to the younger members of our firm—not my two boys alone, but my two sons-in-law as well.—*A. I. Root.*

A. I. ROOT AMONG HIS PLANTS IN THE GREENHOUSE.

A B C Picture Gallery of Apiaries & Bee-exhibits.

During the years since our journal, *Gleanings in Bee Culture*, was started, a large number of fine and beautiful engravings of apiaries and of bee and honey exhibits have been presented to our subscribers. These engravings were executed at considerable cost; and as they are instructive, and suggestive of many ideas in regard to apiaries and exhibits, I have thought best to put the better part of them in permanent form right after our biographical sketches. Instead of going to a large expense in visiting different apiaries, one can see how different bee-keepers arrange their hives, and how their apiaries look. The apiary below is very suggestive, on account of its being on a side hill. The owner, Mr. A. E. Manum, can, from any part of said apiary, see whether swarms are out, or whether robbers are attacking a weak colony. So each engraving in order will be found to contain some hint or distinctive feature which I trust will be found valuable. As our space is limited, I give a brief description of each engraving by number. The unsigned sketches were written by W. P. Root.

NO. 1.—A. E. MANUM'S SIDE-HILL APIARY.

NO 2.—APIARY OF R. G. HAWN, THORPE, WASH. "BEES AND FRUIT."

NO. 3.—APIARY OF VERNON BURT, NEAR MEDINA, O.

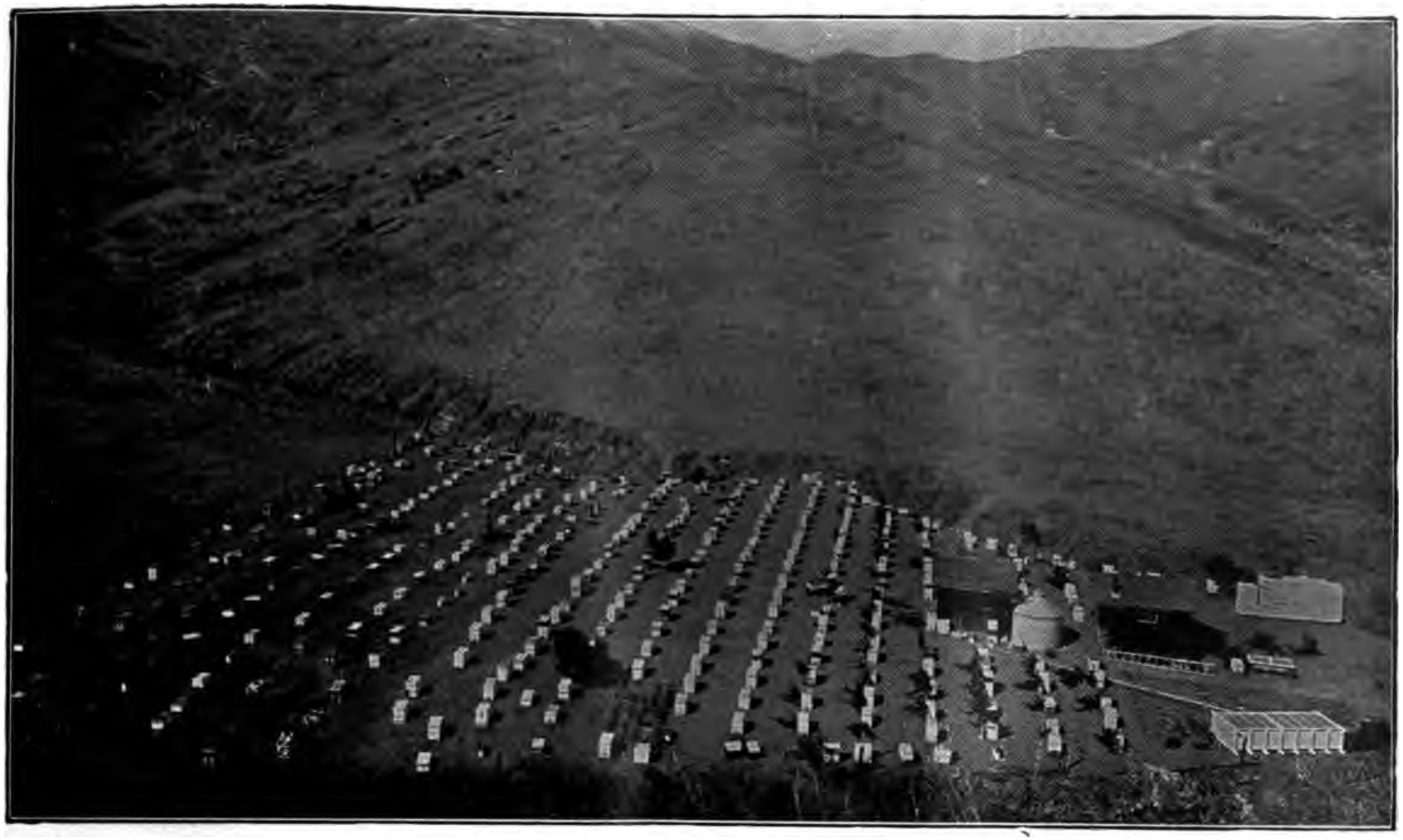
NO. 4.—APIARY OF A B. THOMAS, IN THE SALT LAKE VALLEY, UTAH.

NO. 5.—AN OUT-APIARY OF O. W. STEARNS, SELMA, CAL.

NO. 6.—APIARY OF W. T. RICHARDSON, SIMI, CAL. SEE NO. 25.

W. BRODBECK, LOS ANGELES, CALIF.

NO. 9.—"THERE, TOM, YOU SAID I COULDN'T AND DASSEN'T."

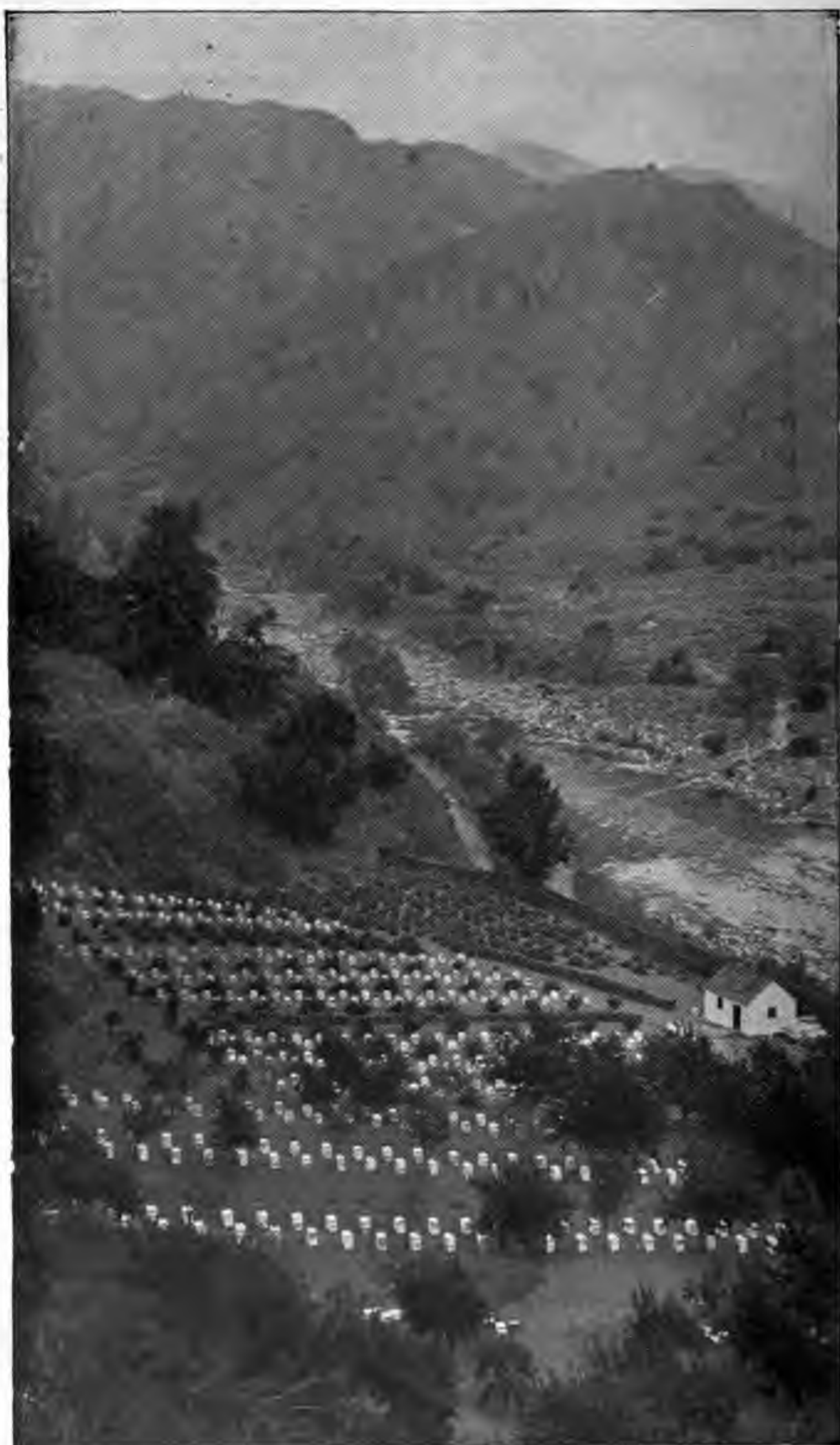


NO. 10.—HOME APIARY OF M. H. MENDLESON, VENTURA, CAL.

NO. 11—APIARY OF GEO. E. HILTON, BENZIE CO., MICH.

NO 12.—APIARY OF WESSING BROTHERS, NEAR NICOLAUS, CAL.

NO. 13.—BEE-YARD OF T. H. ERICK, NICOLAUS, CAL

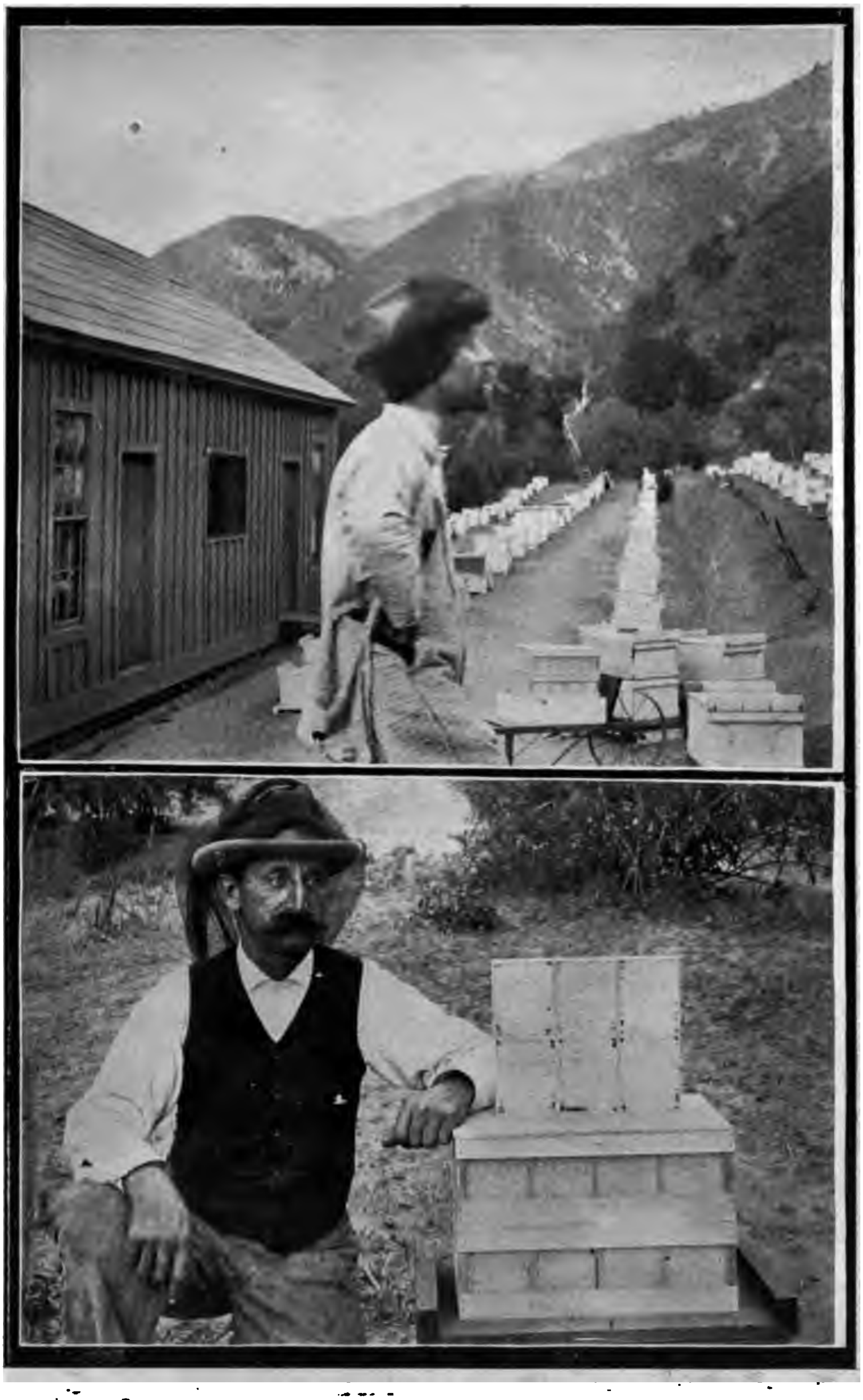


NO. 14.—APIARY OF J. F. M'INTYRE, NEAR VENTURA, CAL.—LOOKING EASTWARD.

NO. 15.—HIVES, JUST FROM AN OUT-YARD, BELONGING TO DR. C. C. MILLER, MARENGO, ILL.

NO. 16.—SOLAR WAX-EXTRACTOR, HAVING ARTIFICIAL BOTTOM HEAT ATTACHMENT, BELONGING TO PHILIP LARGE, LONGMONT, COL.

NO. 17.—HOME OF DR. C. C. MILLER, MARENGO, ILL.



NO. 18.—MENDLESON'S TERRACED APIARY; MENDLESON AND SOME OF HIS FANCY COMB HONEY.

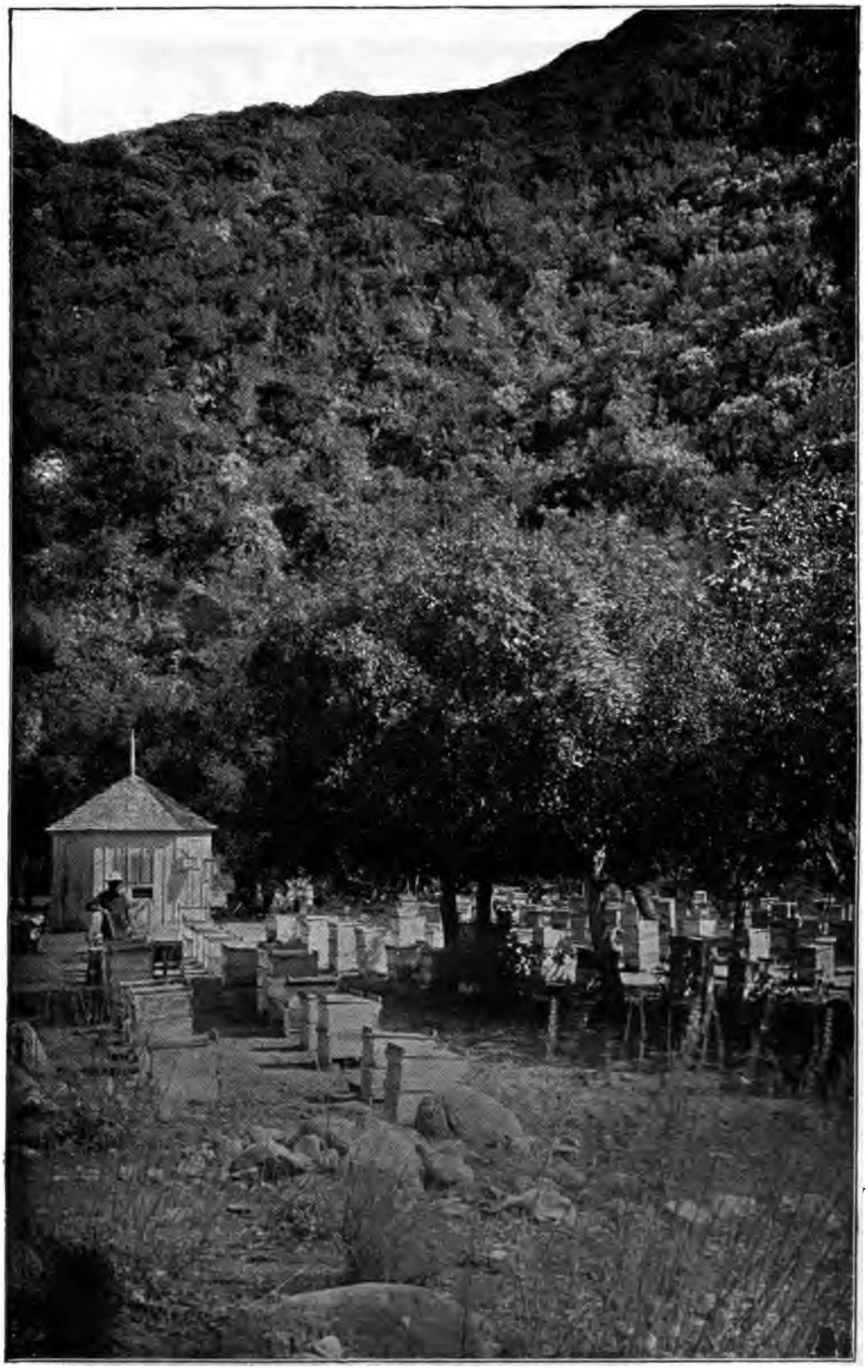
NO. 19.—J. WEBSTER JOHNSON, OF ARIZONA, AT HOME AMONG THE CACTI OF HIS FRONT YARD.

NO. 20.—LARGEST BASSWOOD-TREE IN THE WORLD, LINWOOD PARK, OHIO.

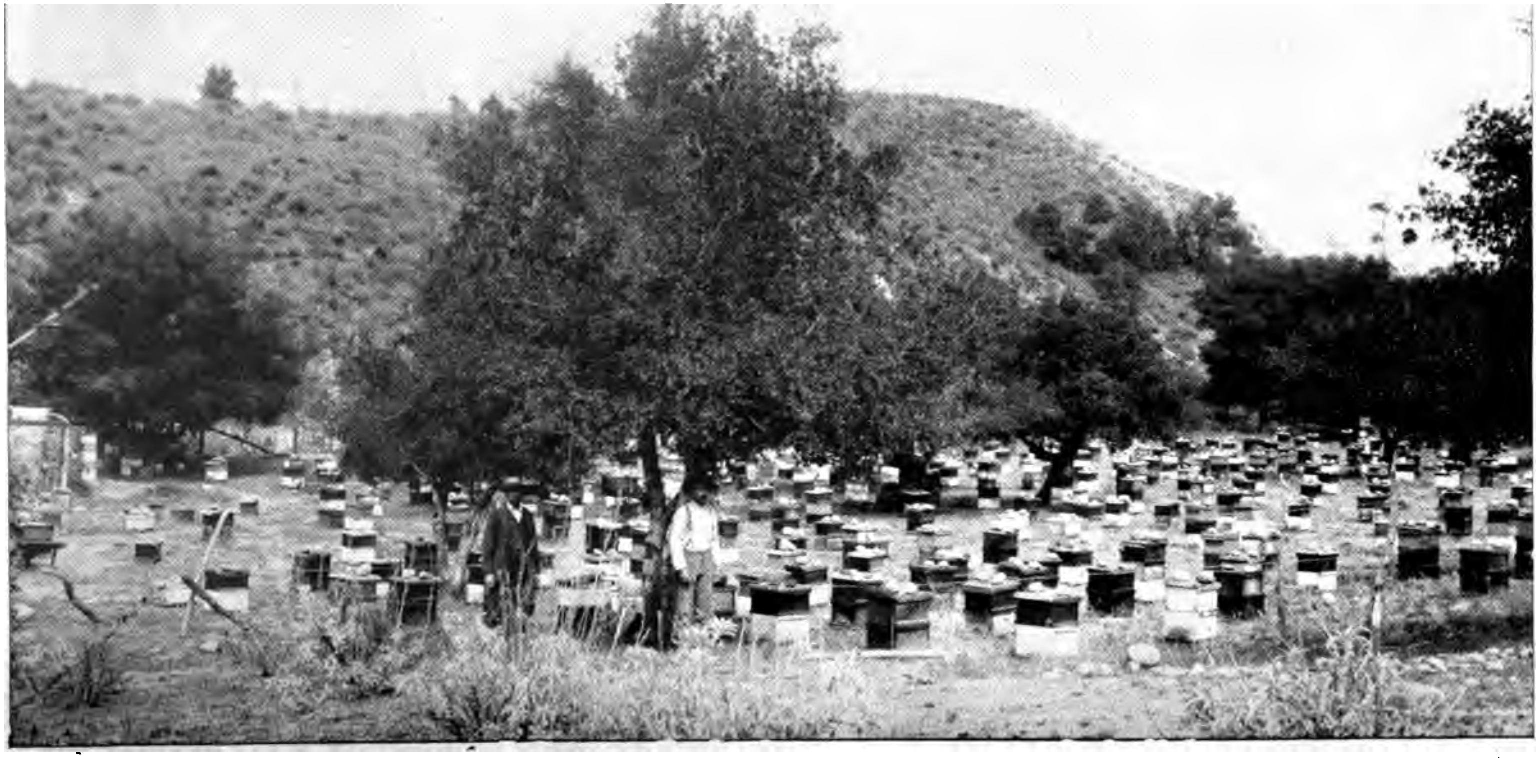
NO. 21.—W. S. HART'S APIARY, HAWKS PARK, FLORIDA.

NO. 22.—APIARY AND RESIDENCE OF JULIUS HOFFMAN, CANAJOHARIE, N. Y.

NO. 23.—AN APIARY IN CHILE.



NO. 24.—APIARY OF J. J. RAPP, MATILIJA, CAL.



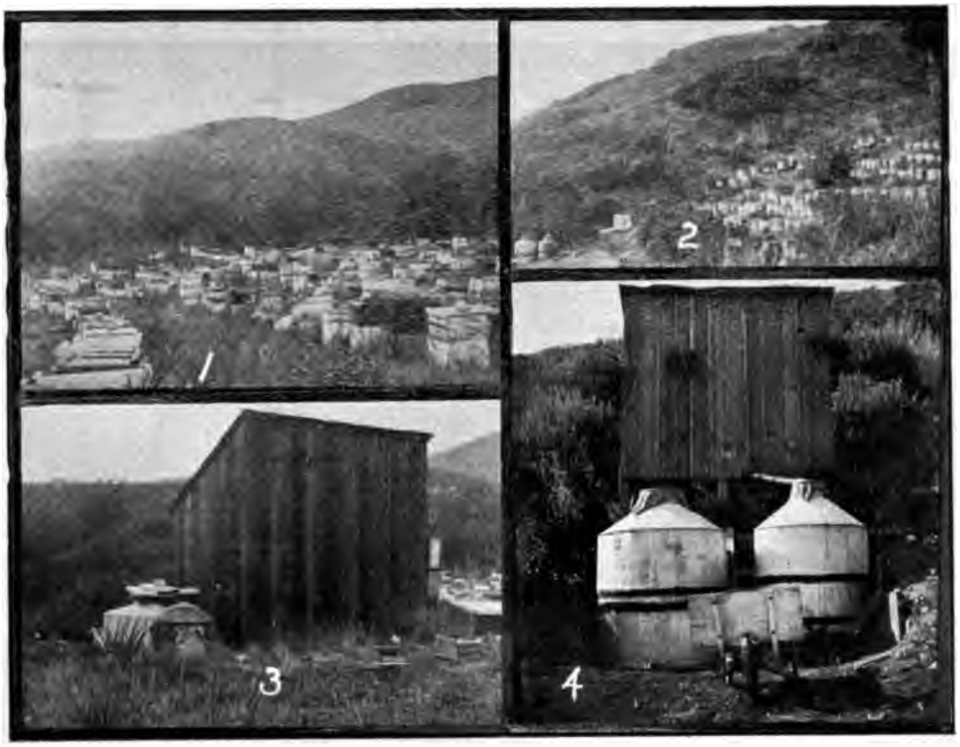
NO. 25.—APIARY OF W. T. RICHARDSON, SIMI, CALIFORNIA.

NO. 26.—MEL BONUM APIARY, GOODNA, QUEENSLAND, AUSTRALIA, SAID TO BE THE LARGEST QUEEN-REARING ESTABLISHMENT IN THE SOUTHERN HEMISPHERE.

NO, 27.—EXTRACTING-HOUSE OF J. M. JENKINS, WETUMPKA, ALA.

NO. 28.—TWO MORE VIEWS OF J M. JENKINS' YARDS, WETUMPKA, ALA.

NO. 29.—MR. COGGSHALL AND HIS HELPERS READY TO START FOR THE OUT-YARDS.



NO 30.—HITCHINGS AND MCCLURE APIARIES, CALIFORNIA.

NO. 31.—MIKE WALL, TEMPE, ARIZ., AND PILE OF ODD-SIZED FRAMES.

NO. 32.—EXHIBIT OF THE A. I. ROOT CO., OMAHA, NEB.


CHAS MC CULLOCH & CO.

NO. 34.—L. L. LANGSTROTH IN HIS 82ND YEAR.

Description of Preceding Engravings.

No. 1.—This picture shows A. E. Manum's side-hill apiary. This spot was selected because the ground is descending, thus affording good drainage and Mr. Manum thinks the bees can locate their hives better in such a place, especially the young queens when they go out to mate; and as every hive can be seen from the honey-house, the attendant can be watching for swarms while working inside. It must not be supposed that this hill is very steep, as the picture would lead one to think, as the descent is very slight; neither are the hives arranged on the amphitheater plan, but are set in straight rows. Mr. Manum has three apiaries on level ground, and he finds the water from melting snow often makes it too damp for the bees; hence his preference for a slope.

No. 2.—This picture has a double interest. It shows the apiary of R. G. Hawn, Thorpe, Washington. It is located in an apple-orchard, and the view shows the almost incredible size and quantity of fruit provided by nature when assisted by its hand-maidens, the bees. Such a large number of fine apples can not be accounted for except on the supposition that bees have full access to the blossoms, thus fertilizing them to perfection. The picture is a good object-lesson in bees and fruit.

No. 3.—This represents the apiary of Mr. Vernon Burt, situated but a few minutes' drive from Medina. It is situated mostly in the shade of venerable apple trees, and is another beautiful combination of bees and fruit. In the springtime millions of blossoms are within reach of the bees if the season is favorable. Mr. Burt always has a good crop, and is very successful with bees. He is referred to several times in this work. He is a strong advocate of the Danzenbaker system and hive.

No. 4.—In the summer of 1891 Mr. J. H. Martin (Rambler), on his way to California, called at this apiary, and says of it:

"The picture gives you a view of an apiary in the Salt Lake Valley, Utah, and is the property of A. B. Thomas, of Springlake. Mr. Thomas and his son are the parties in the apiary. The owner looks a little surprised, for the photo was taken soon after the apiary had been moved to its present location, and he was hardly ready for having pictures taken. The apiary is worked for extracted honey, and the yield in 1891 was about 100 lbs. per colony. The crop was mainly from sweet clover. The apiary is located in a fruit orchard.

No. 5.—This picture, from J. H. Martin, shows one of the out-apiaries of Mr. O. W. Stearns, of Selma, Cal. He owns about 500 colonies. Mr. Stearns has no honey-house and outfit at his out-apiaries, but carries all his tools in a wagon, including the tent shown. On arrival at a yard he puts up a tent, which, Mr. Martin says, is a fearfully hot place when the temperature outside is above 100. Mr. Stearns has secured as much as 23 tons of honey in one season, and is considered one of the best bee-men in that State of great bee-men.

No. 6.—This is a view of an apiary owned by W. T. Richardson, Simi, Cal. It is located right in the hills where the plow can not usurp. A corner of a forty-acre olive-orchard is shown at the right. The olive has a small blossom, but the bees work on it to advantage. We are indebted to John H. Martin for this view and remarks concerning it. Mr. Martin has done more to describe and illustrate bee-keeping in California than any other man.

No. 7.—This shows the apiary of Mr. Geo. W. Brodbeck, Los Angeles, Cal. Th view was furnished us by Rambler, who says: "The apiary is located in narrow quarters, and close to one of those little eucalyptus groves so common in and near Los Angeles. The reader will observe from a mere glance that Mr. Brodbeck is a scientific bee-keeper." He uses a hive that takes a Hoffman frame 16⅝ inches in length, and 7 in. deep.

No. 8.—Mr. Chalon Fowls, of Oberlin, O., has for twenty years been a practical bee-keeper; but his specialty of late has been the marketing of a high quality of extracted honey in bottles and tumblers. He puts up such a fine article, and in such an attractive style, that the trade all around about him is willing to pay double price for the sake of getting his goods.

The first essential, he says, is a thick, well-ripened, extracted honey, either clover or basswood, running about 12 pounds to the gallon. It is heated to a temperature of about 160, and bottled and sealed while hot in jelly-tumblers and in self-sealing jars. For heating the honey he finds a gasoline-stove best, as an absolutely uniform temperature can thus be maintained—something that he can not do on a common cook-stove. If the honey is in square cans the cans are immersed in a pail of water, and the water around the honey is brought to the requisite temperature. After it is melted it is siphoned out into the filling-tank, which is shown in the illustration. His daughter fills the jars. Mr. Fowls crowds the caps on, having first put on top of the jars two thicknesses of paper. Mrs. Fowls, at his left, puts on the labels, when the jars are ready for market.

Mr. Fowls sells all the honey of his own production in this way, and has to buy large quantities besides, to supply his local demands; but he al-

ways makes sure to get a first quality of heavy-bodied light honey. He then puts it up in the winter time, when he can do nothing else, supplying the trade as fast as it calls for it.—*E. R. Root.*

No. 9.—Conducting a *branch* business near the home office is the general tenor of the things represented in the beautiful half-tone No. 6. The two girls have been on a still hunt, and have made a grand "catch." The girl holding the bees certainly has about her "an air of unconscious ease" that meets all the requirements of the case, considering the possibilities bound up in that swarm. And equal praise ought to be given the other girl for standing so calmly by. But after all, what is there to make a bee mad in the presence of such womanly gentleness on the one hand and gentle womanliness on the other, in so beautiful a yard, near so fine a home? Never were bees under obligation to behave better than here. Some might wonder why no man is to be seen. Two reasons might be given. First, he got scared and took to his heels; second, the girl with the bees is looking at him while he takes the picture, hence he is invisible.

The open hive, with all its furniture, certainly offers as good a home for the bees as can possibly be imagined; and it seems a pity that they can never know what man has done for them. The whole picture, although rigidly true to life, reminds one of those dreamy idylls of the poet—a thing we often wish to see, but never find; and it fills the heart with love for our country to think we have a nation of homes like this—differing in details, of course, but still the abodes of comfort and virtue. A "love story" has been suggested. What else does the picture show, from corner to corner? And what physical substance better represents the noblest of all human feelings than honey as a type of love?

We regret that we can not give a continuous moving picture here, showing the way in which the girl puts the bees in their "little bed." Perhaps the first change would show her beating a hasty retreat for that rocking-chair while her father does the rest of the work: but the writer must say, with Dr. Miller, "I don't know."

No. 10.—This shows the home apiary of M. H. Mendleson, Ventura, Cal. Rambler, who photographed the place in 1892, says of it: "A glance at this apiary showed that the owner is a careful, methodical man, and had learned his trade well; for, next to Mr. McIntyre, it was the best-regulated apiary I had seen. The apiary contains 400 colonies, and is worked for extracted honey. The first building at the right is a little work room well supplied with tools. The next little building is the extracting room. The cart in front has room for a large load of hives, which are passed to the operator inside. A galvanized pipe, two inches in diameter, conducts the honey to the strong wooden ripening-tank, holding eight tons of honey." To meet the needs of an extra flow, there is an "emergency tank" at the corner of the extracting-room. The two tanks hold about 27 tons. Two sun wax-extractors take care of all the cappings and odds and ends. Mr. M. is seen manipulating a hive near the small wax-extractor. When the tank is not used for honey, water is caught in it and stored for drinking and irrigating. Rambler says he drank some that had been stored nine months, and it was cool, fresh, and sweet. Full particulars concerning this great apiary will be found in *Gleanings in Bee Culture*, page 462, 1892.

No. 11.—This represents an apiary in Northern Michigan, near Thompsonville. It is the property of George E. Hilton, who has two other apiaries near here. Mr. Hilton is seen at the right. Leaning against a hive-cover is Mr. J. T. Calvert, of The A. I. Root Co. The boy behind the veil is the son of the man who manages the apiary. For years to come Northern Michigan will be an ideal location for honey, and bee-keepers are fast bringing in their bees there. There are many places here where bees have access to raspberries, basswood, and willow-herb; and as fast as the land is cleared, white clover comes in and completes the chain, making one continuous flow from spring till fall. W. Z. Hutchinson, of the *Bee-Keepers' Review*, to whom I am indebted for the facts above, says, "Desolation is the one word that best describes that country from which the lumberman has stripped the pine timber. Stumps, logs, brush, and fallen tree-tops cover the ground in a great confusion that is indescribable. After the summer's sun has poured down on this mass of resinous material only a spark starts a fire that sweeps across the country, mile after mile, leaving the earth bare and blackened."

No. 12.—This is a view of the Wessing Brothers' apiary, near Nicolaus, Cal., taken by E. R. Root in 1901. The great elevation of the hives is on account of high water there at certain seasons.

No 13.—The following cut shows a view of J. H. Erick's bee-yard, side view, also elevated to escape the floods. The most destructive inundations here are occasioned by what is called "placer" mining. The dirt washed down has filled the old river-bed, causing it to leave its course and carry destruction and death in its wake.

No. 14.—This shows a general view of J. F. McIntyre's apiary, located about three miles from Ventura, Cal., on the Big Sespe River. Those who have the older editions of this work will remember a wood engraving of this apiary, then owned by the father-in-law of Mr. McIntyre, R. Wilkin, a name known the world over among bee-keepers. Mr. McIntyre keeps track of his colonies entirely by the use of a record book. The hives are all painted white, and look like a miniature city. The surrounding mountains form a very picturesque feature in the scene. At the right in No. 10 is the honey-house. At the left of the honey-house are three large tanks, not shown, holding four tons each. A full description of this, probably the most important apiary in California, will be found in *Gleanings in Bee Culture*, Oct. 1, 1891.

No. 15.—This is a view of Dr. Miller's outyard, showing bees in their temporary location preparatory to being removed to their summer quarters.

No. 16.—During a trip to Colorado in 1900 Mr. Root made a visit to Mr. Philip Large, of Longmont, and was there attracted by the sight of a large solar wax-extractor, elevated as shown in the

cut so as to allow of extra heat being applied underneath. At the back end there is a cupboard door communicating with an air-tight compartment. In this is a large lamp placed under the slanting part of the extractor. Mr. Large was greatly pleased with the working of the extractor. For information regarding the practical working of solar extractors, see that subject, page 350.

No. 17.—This is an inside and outside view of the home of Dr. C. C. Miller, Marengo, Ill. From this place has probably proceeded more literature relative to bees than any other home in the country. The doctor is here seen at work at his type-writer, surrounded by all that makes life pleasant. At the bottom will be seen a rack on which he puts his hives when hauling them on a wagon from place to place. In the upper corner is a rear view of the house. The rest of the picture is self-explanatory. See Biographies for further particulars concerning Dr. Miller.

No. 18.—This picture was taken while the reviser of this book was visiting Mr. M. H. Mendleson, near Piru, Cal., in 1901. The upper part represents him taking a view of the Limekiln apiary of Mr. Mendleson, in Limestone Canyon. There were about 500 strong colonies in the yard at the time. The ground has been dug away so as to form terraces on which the hives rest. The lower view shows Mr Mendleson beside a pile of his fine comb honey. For further particulars concerning Mr. M. as a bee-keeper, see Biographies.

No. 19.—This is an Arizona view, taken by E. R. Root during his visit there in 1901. It represents Mr. J. Webster Johnson, Secretary and Manager of the Arizona Honey Exchange, an organization that handles a large part of the honey produced in that part of the country. Mr. Johnson is sitting near an immense cactus-plant, a strange piece of vegetation characteristic of that State. The temperature was 110 when the picture was taken.

No. 20.—While California may boast of the largest trees of one kind in the world, we believe Ohio can justly claim to have the largest tree in the world which is most intimately connected with bee-keeping—the basswood. It stands on the shores of Lake Erie at Linwood Park, and is a magnificent sight. In the opening near the foot will be seen a young man of about 18. Inside of the tree is a hollow space large enough to take in a family of six or eight people. It is eight feet in diameter, and towers far above the surrounding trees. An attempt was made to photograph the whole shaft, but the light was too dim. This basswood patriarch stands 30 miles west of Cleveland, and is an object of curiosity to visitors, who are sure to be impressed at the enormous proportions of this proud monarch of trees.

No. 21.—This picture shows a glimpse of one of the most important apiaries in Florida—that of W. S. Hart. At the left is a section of bee-sheds covered by scuppernong grapevines. This kind of grape grows enormously, and is going over the palmetto-trees, shutting off the view beyond. This picture was taken July 17, 1890. The principal object in taking it was to show a cabbage palmetto in full bloom, but the buds were not quite perfected. You will notice Mr. Hart holding a sprig of the bloom over his head. This will give an idea of its size and form. Mr. Hart's reports from this apiary are among the largest and most astonishing the world has ever seen. In 1894 he received from one hive 554¼ lbs., and averaged 354 lbs. from 116 colonies.

No. 22.—This picture is of especial interest to bee-keepers, it being the home of Julius Hoffman, the inventor of the frame bearing his name. We can not do better here than to copy a few words concerning it, written by Mr. J. H. Nellis, in 1892. Mr. Hoffman's picture will be found in the Biographical Sketches, which see. Mr. Nellis says: "The reader looks toward the northeast—i. e., the house fronts the south. The bees shown in the engraving are not the home apiary, but a lot bought from out-apiaries, and placed here expressly to show in this picture. The man near the center, in shirt-sleeves, is Mr. Hoffman. To his right stands his daughter Lizzie, a pretty assistant of no mean value. To the extreme right is Mrs. Hoffman, and in the background may be seen other members of the family. At the left appears Mr. Hoffman's faithful man, who has helped for some years. Behind the young man, to the left, can be seen the barn, wagon-house, and farm-buildings. To the extreme right, and partially hidden, is the shop and honey-house, a two-story building about 22x32 feet. On the upper floor are stored the box-honey, and fixtures used in its production. Underneath is a cellar about 19x29 feet."

No. 23.—Every thing connected with the little republic of Chile is just now receiving world-wide attention. Within a few years it has become the dominant factor in the world's politics south of the equator, and is virtually the arbiter and umpire of discussions in regions where the north star is always invisible. The country has been developing greatly in wealth and educational matters of every description. In the midst of all this brushing-away of old-time cobwebs that have so long hung over her windows, bee-keeping has kept an equal pace. We have no statistics as to the number of colonies of bees kept there, nor concerning the amount of honey and wax produced; but from what I have read in *Apicultor Chileno*, a Spanish bee-journal published in Santiago, the capital of Chile, it is evident that they have burned every-thing that is out of date, and are satisfied with nothing but the very best and newest. Fig. 18 shows a modern apiary in Concepcion, in the agricultural school of that place. It represents 20 dovetailed hives manufactured by the publishers of this work. The number will be doubled the coming season. It is not stated why the hives are elevated on stands, but probably for greater convenience. The general surroundings indicate a place under a high state of improvement, and probably few bee-keepers have a better place to manipulate their hives. Concepcion is as far south of the equator as Richmond, Va., is north.

No. 24.—This view represents the apiary of J. J. Rapp, Matilija, Cal. The mountain back of the apiary is a most beautiful one, and is covered with an even growth of evergreen chapparal. The California lilac predominates. It commences to bloom at the foot of the mountain, and a zone of blue extends upward day by day until the summit is reached. Only a small portion of Mr. R 's apiary is shown here, as he had at the time

picture was taken, in 1892, about 320 colonies. The writer of this book visited this place in the winter of 1891.

No. 25.— The leading honey-producer of Southern California is W. T. Richardson, of Simi. One of his apiaries is represented in the picture, a somewhat grotesque appearance being imparted to it by the stones on the hives, to keep the covers from blowing off. The view is one of many taken by the Rambler while making the rounds of the bee-yards of California. Mr. Richardson runs about 1200 colonies, in four apiaries, all situated in the Simi Valley. A full account of his history is given in *Gleanings* for 1898, page 720, where a portrait is given of this famous bee-man.

No. 26.—We have here a very fine view of one of the largest, if not the largest, queen-rearing apiaries in the southern hemisphere. It is operated by Mr. H. L. Jones, of Goodna, Queensland, Aus. This apiary contains about 300 colonies; and while it presents a remarkably neat and orderly appearance, its owner says it was not "got up for the occasion," as the photographer came along unexpectedly. It is very seldom that one sees an apiary of such trim neatness in its usual working order. On the other hand it is not uncommon to see hives in the average yard more or less tipped sidewise, a little out of square with the points of the compass, weather-beaten, unpainted, besides quite an array of old broom-frames, sticks, old covers, old bottom-boards, and other things too numerous to mention. I do not mean to say that bee-keepers of this country are disorderly; but in the rush of the season, when everything is "hurrah, boys!" and "any thing and every thing to get there quickly," we are liable to find things not quite dress-parade style for a snap-shot photo.

No. 27.—This view was taken by E. R. Root in the summer of 1901 while visiting Mr. J. M. Jenkins, of Wetumpka, Ala. The building shown is an extracting-house. It is made up of panels so that the house can be taken down at any time, and its parts loaded on to a wagon when necessary to move to another yard. This yard contained about 100 colonies. The panels of the building are so closely jointed as to be almost imperceptible in the picture. Mr. Jenkins is one of the most successful bee-keepers in the South, and is widely known.

No. 28.—These pictures were also taken by Mr. E. R. Root during his trip to Alabama. The upper one represents the home yard under a long shed, and the lower one is the Evelyn yard, under the supervision of Mr. H. Fitz Hart, one of the best-informed bee-men in our ranks. Mr. Jenkins is seen sitting on a hive, quite at his ease amid the flying bees. The trees are pines.

No. 29.—W. L. Coggshall, of whom there is a biographical sketch in the Biographies of this work, is here shown with his helpers in front of his residence, preparatory to their start for the out-yards. Mr. Coggshall and his youngest son are, in this, shown in the wagon. The boys will run on ahead with their bicycles, and Mr. C. will arrive right in the height of the work.

He arranges to have at each outyard a cheap extracting building, an extractor, uncapping-can, uncapping-knives, smokers, kegs, barrels, and everything else that one can possibly need in a well-regulated extracting-yard. By far the greater portion of the going to and fro between the outyards is done on bicycles, as much better time can be made; and when the work is finished at one yard the boys jump on their wheels and rush to another. It is not necessary to carry anything along, because, as explained, everything is on hand at each yard; but on big days the wagon is usually taken along to pick up the few stray odds and ends and to supply the several yards with such little articles as they may happen to need.

Further particulars in regard to Mr. Coggshall's methods will be found in the Biographies already referred to.—E. R. Root.

No. 30.—These pictures show the Hitchings and McClure apiaries and honey-tanks. They are representative of dozens that are to be found in California. The house is just large enough to accommodate an extractor, uncapping-box, and the necessary tools for working. The hives, it will be noticed, are located up on the side-hill. The whole arrangement of these California apiaries is such as to provide for honey going down hill all the way, so that about all a man has to do when he loads up his cart or barrow is to let the thing go itself down grade.

No. 31.—While in Tempe, Ariz., the reviser of this book made a visit to the home of Mr. Mike Wall, an extensive bee-keeper who buys up large quantities of bees from parties who do not make them pay, in all kinds of hives and on all sorts of frames, and transfers them to the one he likes best. The picture shows the largest and most grotesque collections of such frames and hives, probably, on earth. It is an object lesson on irregular things, aside from standard makes. What an interesting pile of kindling-wood all that would make on a zero morning when one is in a hurry! Think of the propolis and wax in those frames, ready to burn at the merest suggestion of a match! But, think of the first cost. Mr. Wall is on the right, and W. L. Chambers on the left.

No. 32.—This view represents the apicultural exhibit of the authors of this book at the Omaha exposition. It included a general list of all the apiarian implements in general use, and the story is better told by the camera than by the pen. The educational benefits arising from these exhibits is great. After the above view was taken, a still larger exhibit was made by the same company at the great Pan-American exposition in Buffalo, in 1901.

No. 33.—This cut shows a display of honey made by Chas. McCulloch & Co., dealers in honey, made in Albany, N. Y., in 1891. It was in the form of a house 12x12, and 15 feet high. It took over 400 cases of honey, weighing in all over four tons, to build it. The room inside was handsomely furnished with easy-chairs, center-table, mirrors, rugs, and pretty lace curtains at the windows. Over the door was the appropriate motto, "Home, Sweet Home." It was the headquarters for all honey-producers visiting the fair.

No. 34.—A full-size view of father Langstroth while taking a walk in one of the parks of Dayton, O. Mr. L. was 82 years of age when this view was taken. For further particulars the reader is referred to Biographical Sketches.

INDEX.

ERRATA.—On page 94, second column, thirteenth line from the top, the sentence should read "The honey should be diluted to about the consistency of raw nectar, or in the proportion of *two* pounds of water to one of honey," instead of "ten pounds of water to one of honey."

Gleanings in Bee Culture

An Illustrated Semi-monthly Journal Devoted to Bees, Honey, and Home Interests, Published by The A. I. Root Company, Medina, O., U. S. A., at $1.00 per Year; Foreign Postage 48c extra.

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BEES AND QUEENS

The A. I. Root Co., Medina, Ohio.

IN CONNECTION with and directly adjoining our large manufacturing plant we have an apiary of 600 colonies; and this is further supplemented by a yard in the West Indies of 500 more. Nearly all of these 1100 are devoted to the rearing of high-class *honey* queens or queens for business. In charge of this department we have a queen-breeder of some 15 years' experience, careful and competent, and one who uses the latest and best methods for producing vigorous healthy stock. None but *honey* queens are used for breeders (usually imported — queens whose progeny have excelled every thing else in the yard). Some of them are from our celebrated imported red-clover mother, the bees of which will excel any thing else in the yard during the time that red-clover is in bloom. Then we have a breeder whose bees stored 160 lbs. of surplus from clover and basswood, in a yard where there are already 650 colonies.

On account of the intrinsic merit of breeding stock and the pains we take in rearing our queens, we are compelled to charge a slight advance over ruling prices.

PRICES OF QUEENS REARED IN THE A. I. ROOT COMPANY'S APIARIES.

Untested queen	$ 1.00
Select untested queen	1.25
Tested queen	2.00
Select tested queen	3.00
Breeding queen	5.00
Select breeding queen	8.00
Extra select breeding queens one year old	10.00

Imported Italian Queens.

We are prepared to furnish from the best breeders in Italy, imported Italian queens. They are put into our own yards and tested before sending out. We have only two grades—best and fair imported, and prices are given in the table below:

Best imported queens	$ 5.00
Fair imported queens	3.00

Untested Queens.

An untested queen is one raised from an imported mother, or a breeding-queen whose bees are extra honey gatherers. She is untested because she has laid only a frame or two of eggs; and as these eggs or brood have not hatched into young bees, we do not know yet whether she will be a tested Italian or a hybrid. All we guarantee in an untested queen is, that she was raised from a pure mother, and fertilized in an apiary where Italian drones largely predominate.

Select Untested Queens.

We have calls for yellow untested queens. While we do not regard them any better for real business there are some who go in for beauty. Their bees (for we don't know what they are yet) may not be any yellower than those from our ordidary untestested, and may prove to be hybrids.

Tested Queens.

These are queens that have been laying for a month or so, and their young bees have already emerged from their cells. They have been in the cell long enough so that we know their progeny are pure Italians—that is, bees having three yellow bands, and, as a natural consequence, are gentle. The queens are not bright yellow, but are usually striped with yellow and black. For real business they're just as good as

Select Tested Queens.

Like the tested, their progeny is pure; but the queens themselves are large and yellow, young and prolific. Their bees are gentle and finely marked. The progeny of these queens for real business will probably be no better than those from the ordinary tested. But there are those who wish beauty and utility combined, and, so far as possible, we intend to fill that want.

Imported Italian Queens.

Imported queens, as the name indicates, are queens direct from Italy. While the queens themselves are a little darker than the home-bred queens, they are prolific, and the bees are remarkable for gentleness. We charge more for the imported queens, first, because they cost more; and, second, because they are worth more. While some of them are no better than our home-bred queens, the average run of them are superior. Now, if you want a yellow queen, don't order one of these. The queens, as well as the bees, are leather-colored. Sometimes their bees, while pure, show only two bands distinctly. The third, while present, does not appear until the bees are filled with honey.

Five-banded Stock.

This is simply a fancy stock of Italian bees showing anywhere from three to five bands, from the same queen. They are not necessarily better workers, neither are they more hardy or gentle. Indeed, the reverse has often been true; because in many cases the breeder in running for color seems to lose sight of the *business* qualities. But some of this yellow stock has shown all the desirable points. In offering these queens we do not guarantee that they shall show in the majority of their bees five or even four yellow bands. We shall, however, endeavor to secure the best stock from the best and most conscientious breeders. But if you want bees for business we advise you to get the typical three-banded stock.

Price of five-banded queens same as three-banded in the table for the grade and time of year.

Nuclei and Colonies of Bees.

We are prepared to furnish one, two, and three frame nuclei and full colonies of bees in eight-frame Dovetailed hives or Danzenbaker hives. The nuclei are put up in light shipping-boxes made of basswood, the sides of which are only 3-16 inch thick, and the ends ½ inch. The top and bottom are covered with wire cloth. This makes a very light package, affords plenty of ventilation, and is strong enough to stand shipping from 500 to 1000 miles. The bees so put up almost invariably go through in good order with little or no loss.

EXPRESS CHARGES ON BEES.

The express rate on bees is 1½ first class A one-frame nucleus will weigh about 7 lbs.; two-frame, 10 lbs.; three-frame, 15 lbs.; a full colony, 40 lbs.

WHAT CAN BE DONE WITH OUR NUCLEI.

Any of our nuclei, even the one-frame, will make good strong colonies by fall if properly handled. The three-frame, if properly managed, can be increased four, five, or even ten full colonies by fall if bought in the spring.

PRICES OF NUCLEI.

1-fr. nucleus, without queen	$2.00
2-fr. " "	3.00
3-fr. " "	3.50
One colony of bees in 8-frame hive, without queen	7.50

We can supply with the nuclei any of the queens mentioned in the table of prices of queens. When one buys an extra select queen or any high-priced queen he would do well to have her come in a nucleus. This will insure safe arrival and do away with the hazard of introducing.

ONE-FRAME NUCLEUS.

This contains a frame partly filled with brood and bees; or if it is early in the season, no brood, but the equivalent in an extra number of bees. However, we sometimes send with nuclei a full frame of bees to protect and care for it during the journey. Shipping weight, 7 lbs.

TWO-FRAME NUCLEUS.

This is just the same as our one-frame nucleus, except that it has twice the amount of bees or brood, or of both. The box is larger, and holds two frames—one full frame of brood, or two frames partly filled. Shipping weight, about 10 lbs.

THREE-FRAME NUCLEUS.

This is three times the size of the one-frame nucleus, and is made up in the same way as the one and two frame. Shipping weight, about 15 lbs.

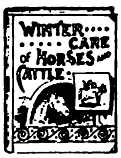
A FULL COLONY.

This will contain eight Langstroth frames in a Dovetailed one-story hive—three full frames of brood, or the equivalent, in six combs, and bees enough to cover fairly all the combs. No queen is furnished at the table price. In this, as in the nuclei, purchaser is to select the queen and add her price to that of the bees. Our colonies are all put up in new Dovetailed or Danzenbaker hives, and painted two coats. Shipping weight, about 40 lbs.

Books on Rural Subjects!

Rural Industries are so Closely Connected with Bee-Keeping that We Include Here a few Books of Our Own Publication.

Winter Care of Horses and Cattle.

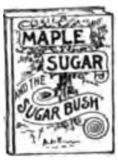


This is friend Terry's second book in regard to farm matters; but it is so intimately connected with his potato book that it reads almost like a sequel to it. If you have only a horse or a cow it will surely pay you to invest in the book. It has 44 pages and 4 cuts (Postage 5c extra.) Price............ .25

A B C of Carp Culture.

In paper covers, illustrated This is a work of 70 pages 7x10, written by Geo. Finley and A. I. Root, and the best authority on the subject of carp culture yet in print. The rearing of carp is a pleasant and profitable amusement. This book will tell you all about it. Post. 5c extra......... .25

Maple Sugar and the Sugar-bush.



By Prof. A. J. Cook. This is by the same author as the Manual of the Apiary, and is most valuable to all who are interested in the product of our sugar-maples. No one who makes maple sugar or syrup should be without it. 44 pages, fully illustrated. Paper. Post. 5c extra. Price...... .25

Tile Drainage.

By W. I. Chamberlain. This is a valuable companion to our other rural books. It embraces the experience of forty years of one of our foremost agriculturists, who has laid with his own hands over fifteen miles of tile. Paper. (Postage 5c extra.) Price .35

Tomato Culture.

In three parts. By J. W. Day, D. Cummins, and A. I. Root. A most valuable treatise, embracing field culture, forcing under glass, and raising plants for market. Valuable to any one raising garden stuff of any kind aside from tomatoes. 150 pages; illustrated. Paper covers. (Postage 5c extra.) Price........... .... .35

A B C of Potato Culture.

This is T. B. Terry's first and most masterly work. The book has had a large sale, and has been reprinted in foreign languages. It was revised and enlarged in 1901, and the third edition makes 290 pages, fully illustrated, cloth cover. (Postage 7c extra.) .... .68

Leatherette cover, printed in gold; post. 5c extra; .45

A B C of Strawberry Culture.

By T. B. Terry. This book has received some very high words of praise. Who that keeps bees does not also have a little garden patch? If you would learn to raise in it that most luscious of all fruits, the strawberry, with the best results, you can not be without this little book. Even if you don't grow strawberries you will be the better for reading it. 1902 edition, 280 pages, illustrated, cloth cover. (Postage 7c extra.)........................ .68

Leatherette cover. (Post. 5c extra)...................... .45

Merrybanks and His Neighbor.

By A. I. Root. This is the title of a little book of 210 pages and 68 illustrations. It narrates the alternate failure and success of a beginner who ultimately, through much tribulation, becomes a successful bee-man and a power for good in Onionville. Appropriate original cuts, many of them humorous, are interspersed here and there, representing some of the droll experiences which a beginner with bees sometimes passes through. Besides bees, it talks of other rural pursuits, such as gardening, maple-sugar making, etc. Paper. (*Postage 3c extra.*)..................... .12

What to Do, and How to Be Happy While Doing It.

The above book, by A. I. Root, is a compilation of papers published in *Gleanings in Bee Culture*, in 1886, '7, and '8. It is intended to solve the problem of finding occupation for those scattered over our land, out of employment. The suggestions are principally about finding employment about your own homes. The book is mainly upon market-gardening, fruit culture, poultry-raising, etc. Illustrated, 188 pages, cloth. (Postage 8c extra.) Price......................... .65

Paper covers. (Postage 8c extra.) Price.......... .40

The A. I. Root Co., Medina, Ohio.

Honey Queens!

Foreign Bee-keepers Please Take Notice! We are prepared to mail to your address, any day, PURE-BLOODED ITALIAN QUEENS at the following prices: Untested, 60c each; 6 for $3.60. Tested, $1.00. Select tested, $1.50. Extra select tested for breeders, $2.50. We rear queens all the year round, and keep over 600 five-frame nuclei in our queen-rearing yard, and 50 full colonies with specially selected Imported Breeders. A trial order will convince you that our Queens are inferior to none, and their workers are good honey-gatherers. Our being in position to start queen-cells any day in the year places us in position to offer our queens at such a low price. We've been at this business for the last 9 years.

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At the Agricultural Show, in Kingston, in 1900, we were awarded all the first prizes--nine in number—in the Bee-keepers Department. This speaks for itself.

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Importers and ifac rs of Bee-keepers' Supplies.

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We have just received another large consignment of Bee-keepers' Supplies from The A. I. Root Co., Medina, Ohio, and are prepared to execute all orders promptly. Buying as we do in carload lots, we secure lowest possible prices; and, having secured special low freight rates, we can furnish you supplies at reasonable prices. Send for catalog, English or Spanish.

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Acabamos de recibir otra gran consignación de accesorios y abastecimientos para colmeneros, de The A. I. Root Co., de Medina, Ohio, E. U. de A., y estamos listos para desempeñar todos los pedidos con prontitud. Como hacemos nuestras compras por lotes en vagón, obtenemos los precios más bajos, y debido á que hemos obtenido tarifas bajas especiales de flete, podemos suministrar abastecimientos á precios módicos. Pídase el catálogo en inglés ó español

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